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STEEL CARS FOR PASSENGER-TRAIN EQUIPMENT.

Steel construction for passenger cars has been suggested for many years, and has been experimented with at different times, but it is only within very recent years that it has become a practical consideration. Steel freight cars have been in extensive and successful use for a number of years, and indications now point to an important development in the use of steel construction in cars for passenger-train equipment. This development has been checked by the financial conditions following upon the crisis of last winter. However, a number of steel cars are in use and under construction, while experimental work is still in progress, both as to design and actual use.

Steel underframing has been used in passenger car construction for some years, but the use of steel body framing and steel sheathing is of much more recent date. In this article we refer only to cars having both underframing and body framing of steel. These cars have been mainly for electrical suburban service and for city rapid-transit lines. Some of them, however, are for main-line train equipment. These latter include not only coaches or day cars, but also baggage, mail, dining, sleeping and parlor cars. In another column we have discussed some features regarding the design and use of steel cars for passenger-train service.

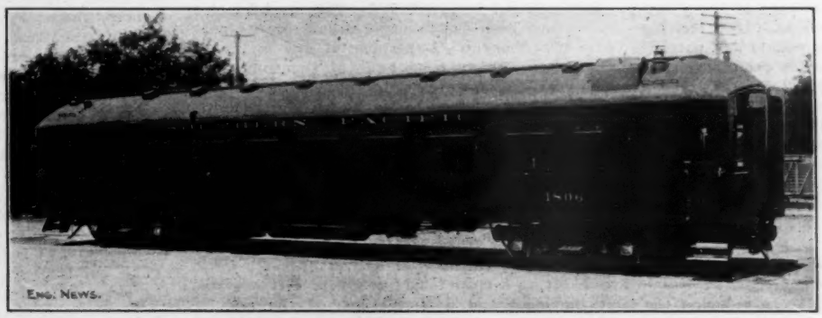


FIG. 1. STEEL PASSENGER CAR; SOUTHERN PACIFIC RY.

The real beginning of steel passenger car construction as a commercial rather than an experimental proposition was in 1902, when it was decided to adopt steel cars for the New York subway or rapid-transit lines. This was soon followed by the adoption of similar construction for the cars for the electrically-operated suburban lines of the New York Central Ry. and the Long Island Ry. The Illinois Central Ry. has also a number of steel-frame cars in its Chicago suburban service. The Interborough Rapid-Transit Co., of New York, has some 350 steel cars on its subway lines, and large numbers have been built for other rapid-transit lines. In fact, this type of construction has become practically standard for underground or subway lines of this class. Even street cars of all-steel construction have been built.

Steel cars for main-line trains are as yet less numerous than those for suburban and rapid-transit service, but coaches and baggage cars are in use to some extent. Steel postal cars are in use on a few roads, their introduction having been aided by the demands of the railway mail clerks for better protection in their work. The United States Post-Office Department has also made urgent representations to the railways in this respect. The wooden cars, open from end to end, having comparatively light upper works, and being placed at the head end of the trains, are liable to suffer severely in collisions. The use of heavier underframe construction does not much improve the conditions. This matter was discussed in our issue of April 14, 1904. The first steel mail car has been in service about 18 years, as noted later.

One of the most definite and important steps yet taken in this direction is that of the Pennsylvania R. R. This road has made long and careful expert investigation of the matter, and about a year ago it announced its intention of introducing not only ordinary passenger cars, but also dining, parlor, sleeping, mail and baggage cars of steel construction, so as to provide the equipment for entire main-line trains. It has also definitely adopted steel cars for its electrically operated suburban service at New York, the trains running through the Hudson River tunnels. The designs for these cars were prepared by the railway company's engineers, and were described and illustrated in our issue of June 20, 1907. Some of the cars are in service and others are being built. Other railways have been working in the same direction, and steel passenger-car construction has been taken up vigorously by some of the large car-building firms. The accompanying table and statement give the results of our enquiries as to all-steel cars in actual use for passenger trains. The total number represented is 1,228, of which about 75% are in suburban or rapid-transit service.

Steel Cars for Passenger Trains.

Penna.	208	N. Y. N. H. & H.	2
N. Y. Cen.	191	Pullman Co.	1
Long Island	185	Interboro	350
Erie	4	Hud. & Man.	50
Southern	3	N. Y. & Q. Co.	40
Ill. Cen.	17	Met. El. (Chi.)	1
Union Pac.	17	Phila. R. T.	80
So. Pac.	3	Boston El.	45
St. L. & S. F.	31	Total	1,228

Pennsylvania R. R.—Mr. Theo. N. Ely, Chief of Motive Power, furnishes the tabular statement given herewith. The delivery of the day cars was commenced in June, 1908, and it is expected that the delivery will be continuous until the orders are filled:

Cars.	In Service.	On order.
Coaches (or day cars)	9	148
Combination pass. and baggage	0	5
Dining	0	10
Postal or mail	3	10
Baggage	1	22
Total	13	195

New York Central Ry.—Mr. C. H. Quereau, Superintendent of Electrical Equipment, states that the road has 125 steel motor cars and 55 steel trail cars. There are also six combination mail and baggage cars under contract.

Long Island R. R.—Mr. Geo. Bishop, Superintendent of Motive Power, reports 132 multiple-unit motor cars and 2 trail cars for the electric suburban service. Also one day car for steam service. There are under contract 50 steel day cars for the steam service.

Erie R. R.—Mr. E. A. Wescott, Superintendent of the Car Department, reports one day car and three mail, baggage and express cars.

Southern Ry.—Mr. A. Stewart, General Superintendent of Motive Power and Machinery, reports three day cars in service.

Illinois Central R. R.—Mr. J. G. Neuffer, Superintendent of Machinery, reports 17 suburban cars.

Union Pacific Ry.—Mr. J. Kruttschnitt, Director of Maintenance and Operation, reports one mail car, one day car, and 15 motor cars in service. None are under contract.

Southern Pacific Ry.—Mr. J. Kruttschnitt, Director of Maintenance and Operation, reports one mail car, one day car, and one motor car in service. None are under contract.

St. Louis & San Francisco Ry.—Mr. Geo. A. Hancock, Superintendent of Motive Power, reports 25 baggage cars and 6 combination baggage and mail cars.

U. S. Post Office Department.—The Railway Mail Service Division reports 12 all-steel mail cars in use, as follows: 5 on the Pennsylvania R. R., 3 on the Erie Ry., 2 on the New York, New Haven & Hartford R. R., and 2 on the Union Pacific Ry. System. It is also stated that the Pennsylvania R. R. intends to have 14 cars (see above), and that the Union Pacific Ry. intends building 35 cars.

Interborough Rapid Transit Co. (New York City).—Mr. J. S. Doyle, Superintendent of Car Equipment, reports 350 steel cars in service. No more are under construction, but 50 have been completed recently.

Hudson & Manhattan R. R. (New York City).—Mr. E. M. Hedley, General Superintendent, reports 50 cars in use.

New York & Queens County Ry.—This electric road is reported to have 40 steel motor cars.

Metropolitan West Side Elevated Ry. (Chicago).—Mr. E. T. Munger, Superintendent of Motive Power and Equipment, reports one steel car in use. None are being built.

Philadelphia Rapid Transit Co.—Mr. F. H. Lincoln, General Manager, reports 80 steel cars in service.

Boston Elevated Ry.—Mr. H. A. Parke, Superintendent, reports 45 steel cars in service.

Many of the steel passenger cars now in use are somewhat heavier than wooden cars in the same service, but it must be noted that as a rule they are also larger than the latter. They are,

of course, very much stronger in proportion to the weight, and this matter of strength is discussed elsewhere. The experimental 60-ft. passenger cars of the Southern Pacific Ry. weigh 107,000 lbs., or 15,000 lbs. more than the standard 60-ft. wooden cars. It is expected, however, that the weight of the former may be materially reduced. The steel passenger cars of the Pennsylvania R. R. weigh 113,550 lbs. (6,000 lbs. for storage battery) and accommodate 88 passengers, as compared with a wooden car carrying 62 passengers and weighing 91,000 lbs. Thus the weight per passenger is only 1,290 lbs. in the steel car, as compared with 1,468 lbs. in the wooden car. The 70-ft. steel postal cars of the Pennsylvania R. R. weigh 128,000 lbs., as against 110,000 lbs. for the 60-ft. wooden cars. On the Southern Pacific Ry. the steel and wooden postal cars weigh 119,800 lbs. and 101,500 lbs., respectively.

FIG. 2. INTERIOR OF STEEL PASSENGER CAR; SOUTHERN PACIFIC RY.

It is very probable that with the development of steel-car building the weight may be materially reduced without in any way reducing the strength of the car. The question of weight is specially important in cars for local service, on account of the frequent stops and starts. Some steel cars for rapid-transit lines are said to be actually lighter than wooden cars of the same type and capacity. In the accompanying table we have summarized the figures of weights of some steel cars now in service, and similar figures given in a report presented at the recent convention of the Master Car Builders' Association:

Weights of Steel and Wooden Passenger Cars.

		Per Passenger			Per Ft. Length		
		Min. lbs.	Max. lbs.	Ave. lbs.	Min. lbs.	Max. lbs.	Ave. lbs.
Steel:	Coach	1,145	1,528	1,352	1,404	1,573	1,435
"	Mail & baggage	...	...	...	1,683	1,996	1,822
"	Suburban	*828	1,648	1,092	1,150	1,758	1,333
"	Various pass. (M. C. B.)	1,145	1,528	1,331	1,313	2,546	1,837
Wood:	Various pass. (M. C. B.)	1,221	1,530	1,353	1,514	1,680	1,564

*Cars for steam service. The other suburban cars have electric motor equipment.

From the above it is evident that the steel passenger car is a practical proposition for both railway companies and car building companies. It will be of interest to consider some of the different designs and features of construction of cars of this kind, and we give herewith descriptions of a number of cars built for passenger train service on different railways. The framing design of such cars is a matter of interest to structural engineers, and the cars described represent different systems of framing.

COACHES OR DAY CARS FOR MAIN-LINE TRAINS.

PENNSYLVANIA R. R.—The cars for this railway were described and illustrated in our issue of June 20, 1907. Their structural design is similar to that of the mail cars of the same railway, which are described later.

SOUTHERN PACIFIC RY.—This road has for some time been designing steel cars for its passenger equipment. Experimental day and mail cars have already been built at the company's shops at Sacramento, Cal. For particulars of these we are indebted to Mr. Julius Kruttschnitt, M. Am. Soc. C. E., Director of Maintenance and Operation, and to Mr. H. J. Small, General Superintendent of Motive Power. The passenger car, shown in Figs. 1 and 2, is 60 ft. long over the end sills and 66 ft. 4 ins. over the platform sills. The width over side sills is 9 ft. 8 ins., and the height from rail to top of roof is 13 ft. 8⅛ ins. The car has an arched or turtle-back roof, giving a clear inside height of 7 ft. 4½ ins. at the sides and 9 ft. 2½ ins. at the middle. The weight is 107,000 lbs., of which the body represents 75,500 lbs. and the trucks 31,500 lbs. The car has seating accommodation for 70 passengers, or a weight of 1,529 lbs. per passenger. The weight given includes the electric light dynamo, battery boxes, etc. In later designs the weight has been somewhat reduced. The wooden cars of similar character weigh 90,000 lbs., without the electrical equipment.

The frame construction is practically the same as in the steel postal car described further on. The side posts are steel angles, with wooden filler pieces, and are fastened to a top angle or side plate which also carries the steel angle carlines for the roof. The posts are spaced alternately 21 ins. and 50 ins. apart, providing for large side windows having lights 25 × 27 ins. The floor consists of a 1/16-in. steel deck, covered with 1½-in. tongued and grooved pine, a layer of mineral wool being placed between the steel and wood. The wooden flooring is covered with a 1/16-in. steel plate, 1/16-in. of asbestos, and a ⅜-in. surface of linoleum. The interior finish is of mahogany, except that the headlining is of 1/16-in. steel plates having the ends flanged and riveted to the carlines. The projecting ends of these are concealed by copper moldings secured by the same rivets which hold the headlining. This arrangement is shown in Fig. 3. The outer roof is also of 1/16-in. steel.

The car is mounted on four-wheel trucks, with 36½-in. wheels and a wheelbase of 5 ft. 9 ins. There being no monitor deck with side openings, ventilation is provided for by a row of Cottier ventilators on each side of the roof. As in some steel cars, the exterior rivets have the outside heads countersunk or concealed by moldings, but in this car they have the ordinary button heads exposed.

UNION PACIFIC RY.—In 1907, this road built at its Omaha shops a steel coach embodying features first introduced in the gasoline motor cars invented by Mr. W. R. McKeen, when Superintendent of Motive Power. Besides its structural design, it presents some novel features in its roof, doors and windows, as shown by Fig. 4.

The side frames are trusses (Fig. 5), the bottom chords (forming the side sills) being angles 6 × 3½ ins. The center sills are two 12-in. I-beams, 16 ins. apart, connected to the side sills by transoms, needle beams and diagonal bracing. The center sills are intended to carry only the buffing and traction stresses, the load being carried by the side trusses. At each end is a steel casting 11 ft. long and 9 ft. 9 ins. wide, forming (in one piece) the end sill and double body bolster. Each casting weighs 3,700 lbs. Upon the underframing is a deck of 1/16-in. steel. This is covered with a ¾-in. layer of hair felt, upon which is a ½-in. flooring of fireproof composition in pressed sheets 3 × 4 ft. There are nailing strips embedded in the felt, and the floor construction is put together with small stove bolts.

The body has cross frames of 3-in. channels, each forming two side posts and a carline for the elliptical roof. Riveted to these are the diagonal truss members. The ⅛-in. steel sheathing extends the full depth of the side of the car. It is riveted to the angle forming the sill, to the 4-in. channel forming the side plate, and also to the posts and diagonals. The windows are 25-in. circular openings fitted with aluminum frames. Instead of the usual entrances, there is a central vestibule with side doors in the truss panels. The ends of the car are rounded in order to reduce wind resistance, and have doors for communication through the train. The interior partitions and lining are of the same composition boards as used in the floor, ⅛-in. thick for the headlining and ¼-in. thick for other parts. The sides of the car are only 2 ins. thick, giving about 7 ins. additional inside width as compared with ordinary construction; this is allowed to the central aisle. All moldings are of fireproof material, and the only wood used (about 200 lbs.) is for small filling blocks.

This car is 68 ft. long, 9 ft. 5⅝ ins. wide over the sills, 12 ft. 1¾ ins. high over all. The inside height is 7 ft. 8¼ ins. It is mounted on four-wheel trucks having cast-steel frames. It seats 78 passengers. The weight is 89,300 lbs., equivalent to about 1,148 lbs. per passenger or 1,316 lbs. per ft.

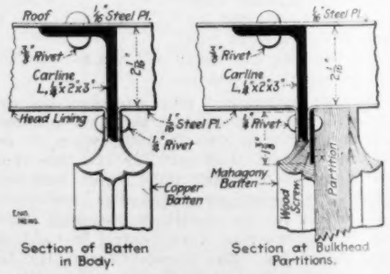


Fig. 3. Carlines and Roof for Steel Car; Southern Pacific Ry.

SOUTHERN RY.—This road has three steel cars which were designed and built by the Pressed Steel Car Co. in 1906. The framing and the outside sheathing below the windows are of steel. There is a large amount of woodwork, however, especially in the upper part of the body, both for structural work and for interior finish. The sides form 36-in. plate girders, and transmit a certain portion of the load through

the bolsters to the center plates. A large portion, however, is transmitted to the center sills and thence to the bolsters. The center sills are of the fish-belly pattern, built up of plates and angles; they are 22 ins. deep at the center and 13½ ins. deep beyond the bolsters. The side girders and center sills are connected by the bolsters and end sills, and by cantilever transoms riveted to the center sills.

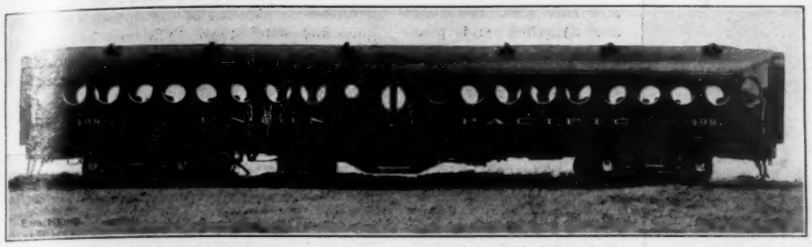


FIG. 4. STEEL PASSENGER CAR WITH MIDDLE VESTIBULE; UNION PACIFIC RY.

The cars are 74 ft. 6 ins. long over the platforms, 65 ft. 6 ins. long inside, 9 ft. 10¼ ins. wide, and 14 ft. 2 ins. high from rail to top of roof. They are mounted on the railway company's standard six-wheel wooden-frame trucks, spaced 50 ft. c. to c. The weight is 74,000 lbs. for the body and 36,000 lbs. for the trucks, or 110,000 lbs. in all. They accommodate 74 passengers each, giving a weight of 1,487 lbs. per passenger. The report of the Master Car Builders' Association committee on steel passenger cars (1908) states that if modern four-wheel steel-frame trucks were used the weight would be reduced to about 99,000 lbs. This would be about 1,338 lbs. per passenger.

LONG ISLAND R. R.—An experimental car built for the steam main-line service of this road is somewhat similar to those for the electric suburban service of the New York Central R. R. (described below). It is shown in Fig. 6. It is 67 ft. 4 ins. long over the platform sills, and has seats for 72 passengers. The weight is 94,500 lbs.; body, 66,800 lbs.; trucks, 22,000 lbs.; storage batteries of the electric-light system, 5,700 lbs. The entire weight is carried by plate girders formed by the sides below the windows, and is transmitted from them directly to the trucks by the bolsters. The center sills have to sustain only the buffing and pulling stresses. The side girders have 3/16-in. web plates, with a top chord composed of a bar 7/16 × 3 ins. and a special bulb angle.

The center sills are 10-in. I beams, 16 ins. c. to c., extending the full length between the platform sills. Each body bolster is in two pieces, 5 ft. apart. The center plate attachment is placed between these and between the webs of the center sills. Between the bolsters are three transoms or cross bearers, with diagonal bracing in the panels between them. There is no corner diagonal bracing, but at each end are two 8-in. channels forming intermediate sills extending from the rear members of the bolster to the platform sill. Two lines of longitudinal angles between the side and center sills, and supported by transverse angles riveted to the webs of these sills, help to carry the corrugated steel deck. Upon this is laid cement flooring.

The body framing comprises posts of 3 x 2-in. angles and 3 × 3-in. tee bars, riveted to the side sills and side plates. The carlines are steel angles. The hood of the roof is stiffened by extending the lower deck sills to the end plate, and using ¼-in. web plates in the triangular end panels of the monitor roof (which extends onto the hood). In each corner panel of the hood there is also a horizontal diagonal brace, extending from the top of the end body frame to the end plate of the vestibule. The roof is of ¼-in. steel. The interior finish is of steel plates and moldings (in several places attached to wooden filler pieces). Steel window sashes are used.

As a result of experience with this car the railway company ordered from the American Steel Car & Foundry Co. 50 steel cars having the underframe similar to that of the Pennsylvania R. R. cars. The center sill is a box girder composed of two 9-in. channels with top and bottom cover plates ¼ × 26 ins. and ⅝ × 24 ins. respectively.

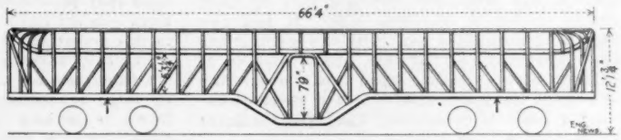


FIG. 5. FRAMING OF STEEL PASSENGER CAR; UNION PACIFIC RY.

STEEL SLEEPING CARS.

The design of sleeping and parlor cars of all-steel construction has been taken up by the Pullman Car Co. in cooperation with the Pennsylvania R. R., and the first steel sleeping car was shown at the Jamestown Exhibition in 1907. This car is 80 ft. long over the platforms, and 72 ft. 6 ins. over the end sills. It has 12 sections, drawing room, smoking room and toilet rooms.

The framing is on the "backbone" system, in which all the weight of the body is carried by a heavy center sill and transmitted directly to the trucks. The center sill is practically a single member, consisting of two 15-in. I-beams with a ½-in. top cover plate. It is stiffened by two 1⅞-in. truss rods, which pass under struts fitted beneath the middle transoms or cross-bearers, and over saddles on the bolsters, the ends being attached to the body end sills. The bolsters, platform sills, body end sills and four cross-bearers are all steel castings. Between the cross-bearers are floor beams of 4-in. channels laid with web horizontal and fitted between the side and center sills. There is a continuous deck of steel plates. These are in lengths of 5 ft. 3 ins. and wide enough to cover the full width of the car. They are cut away or slotted over the trucks to clear the body bolsters. The sides of the car (below the windows) form plate girders. The ¼-in. web plate is about 30 ins. deep; the top chord is a 3-in. bar, while the bottom chord is an angle 6 × 6 ins.

The side posts are 4-in. I-beams, having holes punched in the webs to reduce the weight and to provide passage for the electric conduits. They are from 1 ft. 7 ins. to 4 ft. 3 ins. apart, but mainly 2 ft. 7½ ins. c. to c. They are placed singly and in pairs, the latter united on the outside by a 1/16-in. plate. The upper ends of the posts are bent to form carlines for the side decks, their ends being attached to a tee-bar deck sill. The carlines of the upper deck are alternately 2 × 2½-in. tee-bars and pressed steel channels. They are spaced 21 ins. to 24 ins. apart.

The roof is of galvanized iron with copper flashing. The floor is of corrugated steel covered with a cement composition. Beneath this is a false floor laid upon the cross bearers and floor beams, and the space between the floors is filled with a sound-deadening material. Between the inner and outer sheathing of the sides and ends are two thicknesses of asbestos board to serve for heat insulation and for deadening noise.

There is very little wood finish or decorative work. The seat frames, berth frames and other parts are of pressed steel, and the sheathing of the upper berths is of steel plate. The interior finish is of sheet steel, with headlining of aluminum for the upper deck and composition board for the lower deck. The window sashes are of brass. Fig. 7 gives a good idea of the interior appearance. The simplicity of the finish and the absence of elaborate decorative work are very marked. The car is mounted on six-wheel trucks with cast-steel frames and bolsters and 38-in. wheels. Its weight is a little more than that of sleeping cars of wooden construction, which latter averages from 125,000 lbs. to 130,000 lbs.

MAIL, BAGGAGE AND EXPRESS CARS.

Steel postal or mail cars are likely to be introduced somewhat extensively. This development is approved by the Post-Office Department on account of the greater safety for the mail clerks. As noted elsewhere, the Railway Mail Service Division reports 12 all-steel mail cars now in use. The first steel mail car was built in 1888 to the patented designs of a Mr. Green. This was put on the Chicago, Indianapolis & Louisville Ry. in January, 1889. It is still in service, but has been converted into a baggage car on account of being too small for postal service. In regard to this interesting car, Mr. Charles Collier, Master Car Builder, wrote us as follows in 1907:

> At the time this steel car was built we also built two wooden cars of the same length. The cars have been running between Chicago and Louisville in the same service up to a few months ago, and I cannot say that the steel car has given any better service than the wooden cars, except that in case of wreck the steel car has come out better than the wooden one. I do not believe that any more will be built on this plan of construction, as it is not heavy enough for the heavy locomotives and equipment that are now used.

ERIE RY.—This road has three steel mail cars, two of which were originally baggage and express cars, respectively. It has been reported that they were converted on account of being un-

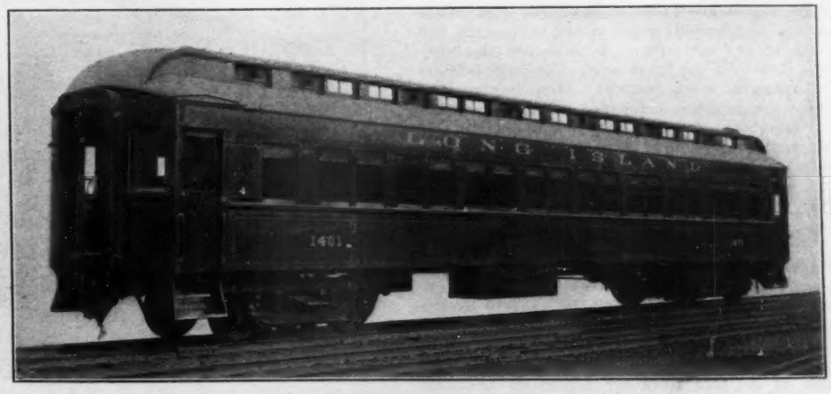


FIG. 6. STEEL PASSENGER CAR; LONG ISLAND R. R.

FIG. 7. INTERIOR OF SLEEPING CAR.
(All the interior finish is of steel and aluminum.)

comfortably hot or cold, but we are informed by Mr. E. Williams, General Mechanical Superintendent, that the change was made simply because it was considered they would be of more value in the mail service. These cars were built by the Standard Steel Car Co. in 1904.

SOUTHERN PACIFIC RY.—A steel postal car designed in accordance with the general design of the passenger car already described was built at the company's shops at Sacramento, Cal. It is 60 ft. long inside and has no end platforms. Special regard has been paid to fireproof conditions, and this car has much less woodwork than the passenger car, the finish and fittings being almost entirely of steel. Fig. 8 is a view of the car and Fig. 9 shows the structural design. It will be seen that no attempt is made to conceal the rivet heads.

The underframe construction includes two 12-in. I-beam center sills and two 5½ × 7 in. angles for the side sills. Between the sills are transverse 5-in. channels about 24½ ins. apart. Outside of each center sill is a truss rod, which passes over saddles on the bolsters and is secured to the end sills. Near the middle of the car are two transoms or needle beams of fish-belly plate girder construction. Their webs and chord angles are fitted between the sills, while the top and bottom cover plates extend the full width of the car. Beneath these are the cast-steel struts for the truss rods. The body bolsters are massive steel castings, each having two transverse members connected by three longitudinal members. They are fitted between the sills and make a very solid construction. In the long panel between the bolster and needle-beam at each end are four diagonal braces of 5-in. channels; these extend between the side and center sills and form a horizontal diamond frame.

The side posts are angles riveted to the side sills and to the angles forming the top side plates. A steel angle forms the belt rail, but the belt rails and side plating are interrupted by the two doors on each side. The plating is 3/16-in. thick up to the belt rail, and then ⅛-in. thick to the side plates. The door frames are angles, and those of the side doors are braced by diagonals extending from the side plate to the sill. The ends are braced by plates ¾ × 3 ins. from the end sills to the top of the frame, and by a 5/16 × 20-in. plate fitted horizontally between the two end carlines in the hood of the roof. The end sills are steel castings fitted between the center and side sills. To these are attached end posts of angles 3½ × 6 ins.

The carlines are steel angles, with the ends flanged out and riveted on top of the side-plate angles. They are bent to the curve of the turtle-back roof, which has a rise of 2 ft. 9½ ins. The roof has a radius of 7 ft. 6 ins. at the middle, 4 ft. 6 ins. at the side and 15½ ins. at the corners. Upon the carlines are riveted the 1/16-in. roof plates. These extend down over the side-plate angles, and are lapped by the ⅛-in. steel plate forming the letter board over the window openings. The carlines are spaced 24 ins. c. to c., and between them are the 1/16-in. steel sheets forming the headlining (Fig. 3). The floor is supported by the center sills, by longitudinal Z-bars on the transverse channels, and by shelf angles riveted to the side sills. It has two courses of corrugated iron (with the corrugations laid transversely of the car), and a packing of hair-felt between them. Upon this is a covering of cement composition, in which a sheet of expanded metal is embedded. The total thickness of the floor is 2 ins.

The sides and ends have an inside lining of asbestos board, and all fixtures (including the letter cases and post-office fittings) are of iron or brass. The only parts made of wood are the window sashes and some fillers in the framing. Ventilation is provided for (as in the passenger car) by Cottier ventilators placed on each side of the roof. The car is mounted on six-wheel trucks, with 36½-in. steel wheels and a wheelbase of 10 ft. 6 ins. The following is a comparison of the new steel car with the company's standard wooden postal cars:

	Steel.	Wood.
Length over end sills	60 ft. 1½ ins.	[illegible] ft. 7¾ ins.
Wheelbase, total	54 ft. 7½ ins.	[illegible] ft. 1¾ ins.
Weight: Body	99,550 lbs.	[illegible],250 lbs.
Trucks	20,250 lbs.	[illegible],250 lbs.
Total	119,800 lbs.	[illegible],500 lbs.

PENNSYLVANIA R. R.—The steel mail cars are 70 ft. long. The underframe is similar to that of the passenger coach, except that four side bearing plates are provided for each truck (six-wheel trucks being used), and the ends are modified on account of the omission of the vestibule and side steps. The end castings of the center sill are of such shape as to provide rigid support for heavy door posts of 12-in. I-beams. These posts are relied upon to prevent any raking of the superstructure in case of collision. Their upper ends are securely framed into the roof structure so that an end shock to the car would be well distributed. The car contains only 370 lbs. of woodwork. Fig. 10 is a cross-section of the side of the car. The belt rail is a flat bar, reinforced by a tee bar fitted between the posts. The roof construction is practically the same as that used in the passenger coach. The door posts support pressed steel jambs, and the doors are of steel. The window sashes are of wood. The inside lining is of 1/-16-in. steel, to which is cemented 3/16-in. of asbestos. All the interior furniture, including the letter cases, is of 1/16-in. steel.

The car is 74 ft. 9¾ ins. long over the platforms and 70 ft. 8¾ ins. inside; its width is 9 ft. 11½ ins. over the eaves and 9 ft. ⅝ in. inside. It is mounted on six-wheel trucks (Engineering News, June 20, 1907), having rolled-steel wheels. The trucks have a wheelbase of 11 ft. and are spaced 54 ft. 9 ins. c. to c. The total weight is 128,500 lbs., including an axle-driven electric lighting equipment.

ST. LOUIS & SAN FRANCISCO RY.—In 1907, some baggage cars and combination baggage and mail cars were built by the Pullman Co. These have four plate-girder sills of fish-belly pattern. Each side sill has a Z-bar for the top chord, and to this are attached the steel 3-in. channel posts of the body framing. Transoms and twin-bolsters are fitted between the sills and secured to them by large connection plates. The entire underframe is covered with a ⅛-in. deck plating. Each alternate post is a complete cross frame, forming two side posts with the connecting carline. Between these are wooden carlines. The corner posts and side door posts are braced by diagonal angles. The posts for the end doors are 10-in. I-beams. The sheathing is of wood.

The sills are designed for a maximum fiber stress of 12,500 lbs. per sq. in., and the underframing is designed to carry a distributed load of 80,000 lbs. The combination cars are 70 ft. long and weigh 117,800 lbs. The baggage cars are 60 ft. long and weigh 106,200 lbs. These weights include 40,200 lbs. for the trucks.

FIG. 8. STEEL POSTAL CAR; SOUTHERN PACIFIC RY.

STEEL CARS FOR SUBURBAN AND RAPID-TRANSIT SERVICE.

ILLINOIS CENTRAL R. R.—This road has 17 steel cars in its Chicago suburban service, operated by steam locomotives. They are of the side-door type designed by Mr. A. W. Sullivan and Mr. W. Renshaw (Eng. News, Nov. 26, 1903). They are 71 ft. 11¼ ins. long over all, and have transverse seats accommodating 100 passengers. The weight is 82,800 lbs., of which the body represents 68,900 lbs. The underframe consists of four 9-in. I-beams, with I-beam cross-pieces, and four truss rods. This is reinforced by a deck of ¼-in. steel plates. The posts are 4-in. channels spaced 28½ ins. apart and riveted to the side sills and top plates. As alternate panels form the side doors, double diagonal bracing (below the windows) is fitted in the other panels. In the end panel of each side there is heavy diagonal bracing extending from sill to side plate to enable the structure to resist heavy buffing or collision shocks.

The top chord is formed by an outside V-shaped bulb angle and an inside flat bar 7/16 × 3 ins. The web is in three pieces, with butt joints and cover plates. The posts are 3 × 2-in. angles, crimped to fit inside the chords. They form web stiffeners, and above the sill (or top chord of girder) some of them are formed by 2½-in. tee-bars. All the posts are attached to an angle 4½ × 3 ins., which forms the side plate. The roof is of the usual monitor type, with carlines of angles 1¾ × 1¼ ins. Fig. 13 is a view of the framing, and also shows the corrugated steel floor.

The center sills are 8-in. I-beams. They are spaced 24 ins. c. to c., but beyond the body bolsters they flare out and are about 5 ft. 4 ins. apart where they are attached to the platform sills. This is done to clear the movement of the radial draft gear, which is pivoted to allow of coupling cars on curves of 135 ft. radius. These sills are subject only to the buffing and traction stresses. They are supported by pressed steel cross-bearers resting on the side-sill angles. Diagonal bracing is provided in the end corner panels and in the panel between the body bolster and the nearest cross-bearer. The bolsters are of cast steel, of I-section, so shaped as to embrace the center sills and side angles. They carry the load from the side girders to the trucks.

The interior finish is of steel plates and moldings with fiber-board for the head lining and the main roof. The roof is covered with painted canvas. Upon the framing formed by the sills, bolsters, cross-bearers and light intermediate angles is laid a deck or corrugated steel sheeting, covered with a cement composition. The wearing surface is formed by wooden strips laid longitudinally in the aisle and transversely between the seats; these are secured by screws. These cars were built by the American Car & Foundry Co.

LONG ISLAND R. R.—The steel motor cars for the electrically operated lines of this road were illustrated and briefly described in our issue of Nov. 2, 1905, in a description of the electric traction system. The sides below the windows are utilized as plate girders. The center sills are I-beams. The transverse members or floor beams are flat plates ⅜ × 4½ ins. (set on edge), having one end flanged to fit against the web of the I-beam, while the outer end is riveted against the side of the post.

A special feature is the use of transverse knee-bracing. At two points on each side, there are transverse diagonal braces of angles 3 × 4½ ins., riveted to the side post and the floor beam. The brace extends below the floor beam and is riveted to a steel casting which fits beneath and between the center sills, thus forming a complete transverse truss. This arrangement is made possible by the use of fixed transverse seats in the center of the car, the braces being enclosed in the backs of these seats. Fig. 14 shows the same plan as used in the New York subway cars of the Inter-

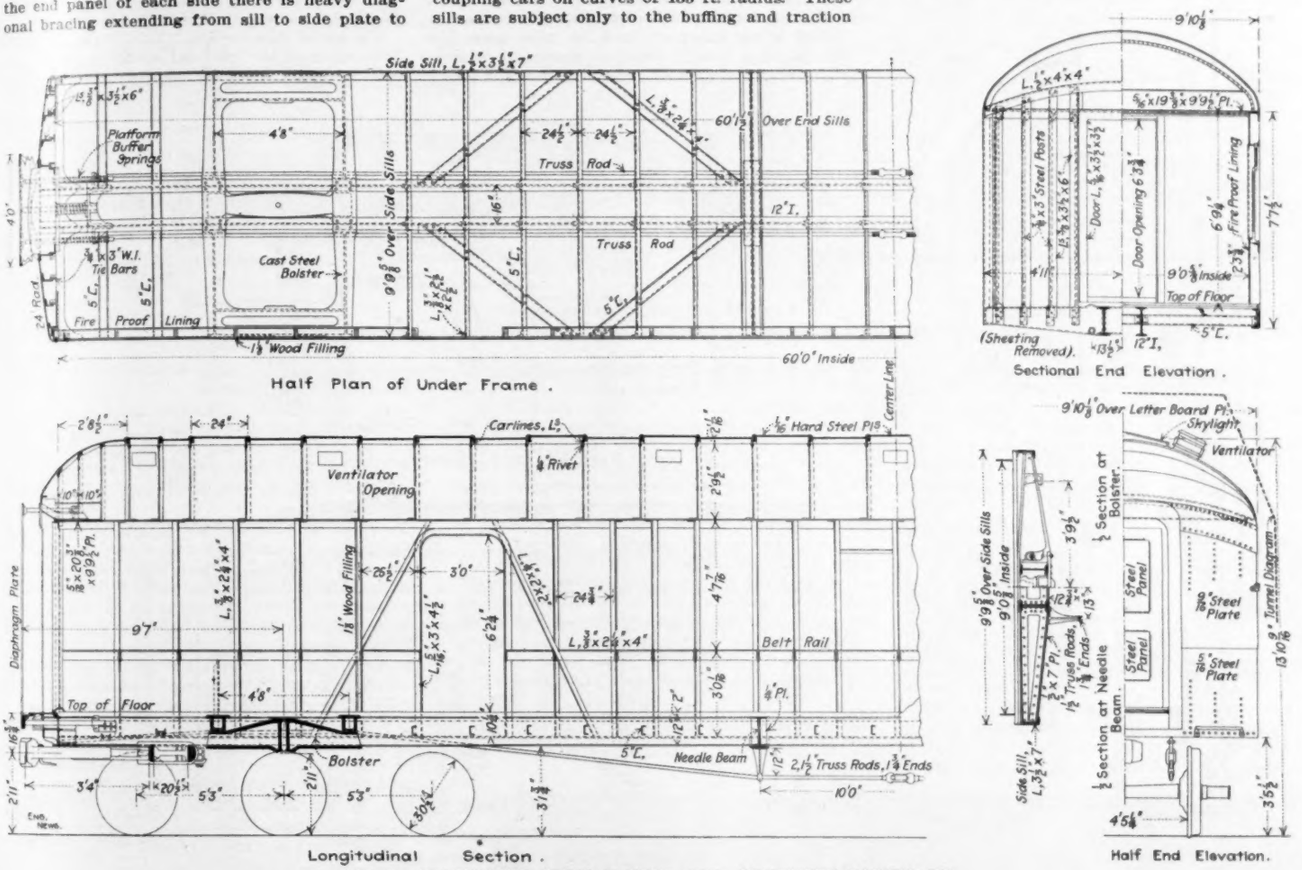


FIG. 9. FRAMING OF STEEL POSTAL CAR; SOUTHERN PACIFIC RY.

NEW YORK CENTRAL RY.—Steel cars have been adopted for the electrically operated suburban lines at New York, as described in our issue of Nov. 16, 1905. There is a considerable amount of wood used for the attachment of the interior finish, but this is fireproofed and is enclosed in steel. These cars are 60 ft. long over the platform buffers, 48 ft. 11½ ins. long inside, 9 ft. 8¾ ins. wide over side sills, and 13 ft. 9½ ins. high from the rail to the top of the roof. The weight is 67,170 lbs. for the body (including electrical equipment), 15,000 lbs. for the motor truck, and 11,140 lbs. for the carrying truck. With 12,000 lbs. for the motor equipment the total service weight is about 105,500 lbs. Each car has seats for 64 passengers.

The framing design is shown in Fig. 11, while Fig. 12 shows a section through the side. The principle of the design is to carry the entire load of the body and underframe by two plate-girders formed by the sides (below the windows), and to transmit this load through the bolsters directly to the trucks. The 3/16-in. web plate is 36 ins. deep, with a 6 × 6-in. angle at the bottom.

borough Rapid-Transit Ry. In these, however, the greater number of cross seats enables additional braces to be used.

The body bolsters consist of top and bottom plates, with spacing blocks. The ends are bent to fit under the side sills, and intermediate sills of 4 × 3-in. angles extend from the bolsters to the platform sills. The body end sills are pairs of angles fitted between the side sills. The side posts are steel angles placed singly or in pairs, and the body corner posts are of built-up construction. The side plate to which the tops of the posts are riveted is an angle extending the full length of the car (to the front of the vestibule), and to this is attached the plate forming the letter board. The roof is of the deck pattern with steel angle carlines bent to shape, and reinforced by projecting angles outside the corners of the upper deck. Between the carlines are longitudinal angles. Maple furring bolted to the carlines serves as the attachment for the roof and headlining, which are of composite board. Over the vestibules the roof is of No. 16 sheet steel. The entire roof is covered with canvas painted with white lead. The floor is of cement on a corrugated plate decking, and has wooden

wearing strips screwed to it between the seats.

The motor truck of each car has 36-in. wheels and a wheelbase of 6 ft. 8 ins.; the carrying truck has 30-in. wheels and 5 ft. 6 ins. wheelbase. The drawbar is pivoted behind the end sill to an eyebar 27 ins. long, whose rear end is pivoted at the center plate. This forms a knuckle which allows for the side swing of the couplers as the cars pass curves of 90 ft. radius, while

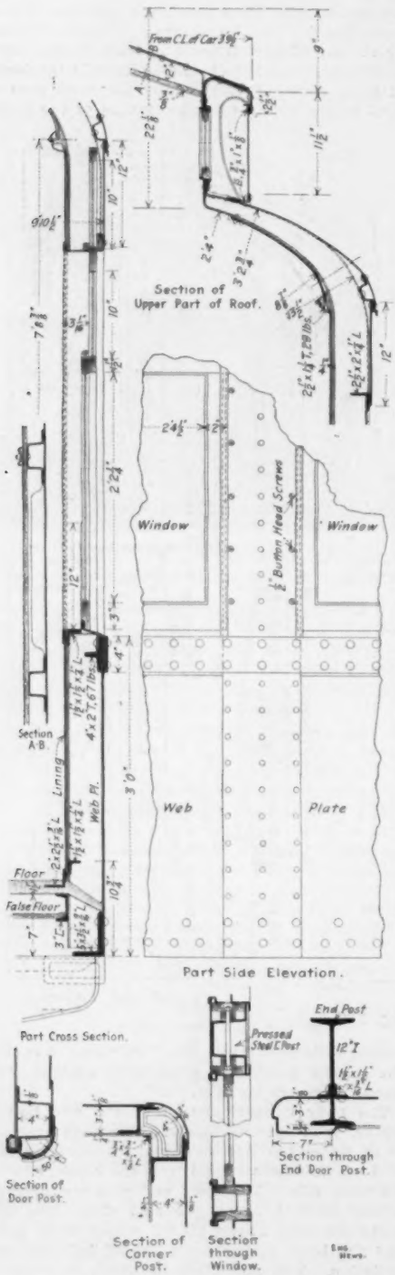


Fig. 10. Cross-Section of Side of Steel Postal Car; Pennsylvania R. R.

reducing the travel of the coupler head. The cars are 51 ft. 2 ins. long over the platform sills; 8 ft. 6½ ins. wide over side sills, and have a height of 12 ft. ¾ in. from rail to top of roof. They were designed by Mr. George Gibbs, Chief Engineer for the electrification of the Long Island R. R., and are practically identical with those designed by him for the New York subway lines, except that the latter (for use with high station platforms) have no side steps. They were built by the American Car & Foundry Co.

PENNSYLVANIA R. R.—The steel cars designed for electrically operated suburban service are shorter and lower than those for main line service (Eng. News, June 20, 1907), but are of very similar design as to the framing. The center sill is shallower, however, in order to provide sufficient space for the motor, the height from rail to underside of sill being 3 ft. 5 ins. This sill consists of two 10-in. channels with a single ¼-in. top cover plate and two ⅜-in. plates. This form of section keeps the center of gravity low and decreases the bending moment brought about by the fact that the drawbar is below the sill. The draft sills (beneath the center sill) are of cast steel. The center plate is of special form to permit the use of the same trucks as are used on the ordinary cars.

The body framing is similar to that of the main line cars, but the main posts are 8 ft. 6 ins. apart, with two intermediate posts between each pair. There is no sub-floor, and no pipe duct, the heater pipes being carried by standards against the side of the car and covered with a top guard

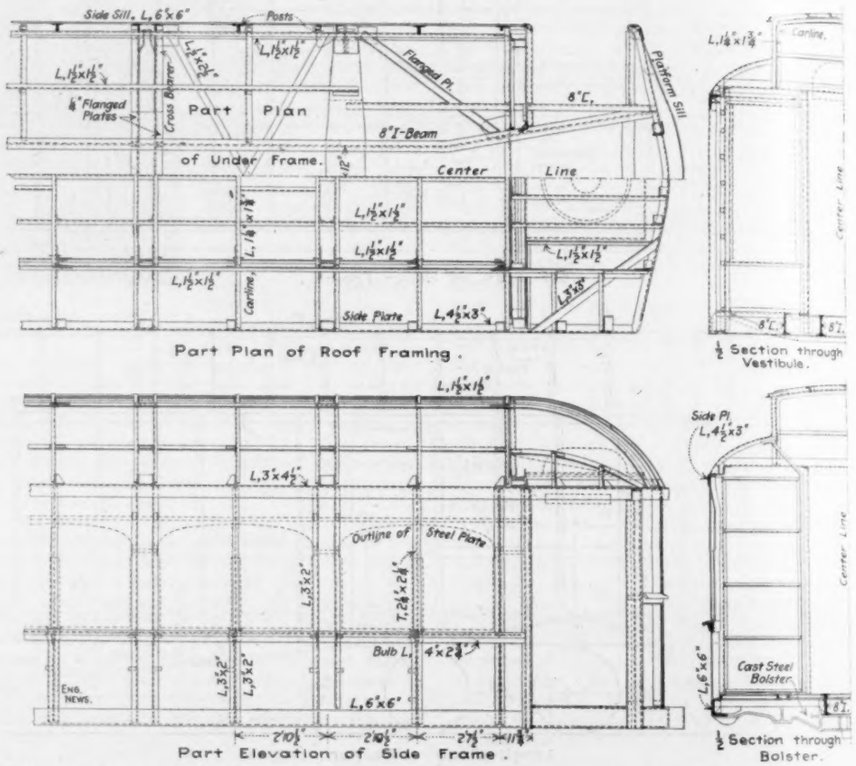


FIG. 11. FRAMING OF STEEL CAR FOR ELECTRICAL SUBURBAN SERVICE; NEW YORK CENTRAL RY.

plate. These cars are 64 ft. 5¾ ins. long over the buffers, and 54 ft. over the end sills. The total height is limited to 13 ft. with a view to the use of an overhead trolley system. They are mounted on four-wheel trucks with a wheelbase of 7 ft., spaced 39 ft. 6 ins. c. to c.

INTERBOROUGH RY.—This New York rapid-transit line has about 350 steel cars, the first of which were built in 1904 by the American Car & Foundry Co. They contain only about 700 lbs. of wood (which is fireproofed). The floors are of cement and the outside roof has a composition board sheathing. The height of the cars is limited, as they are adapted for the underground lines. The sills must be shallow, in consequence, and for this reason the lower part of the side of the car is built as a plate girder, its top chord being a special bulb-angle which forms the belt rail. The cars are 41 ft. long, 8 ft. wide and 12 ft. high over all. They have transverse knee-bracing (Fig. 14), as described in connection with the Long Island R. R. cars.

HUDSON & MANHATTAN RY.—This road has adopted steel cars for its underground rapid-transit line between New York, Jersey City and Hoboken. The cars have vestibule platforms, and a middle door at each side. The door prevented the utilization of the lower part of the side as a plate girder, and the limit of clearance made it undesirable to reinforce the side by a deep sill at this point. The entire side frame of the body (exclusive of the vestibules) is therefore designed as a five-panel truss, with the door in the middle panel. The chords are 10-in. channels forming the side sill and the side plate. The posts are 8-in. channels, with diagonal braces (below the window sill) to the side sill. At the top of the middle panel there are diagonals from the posts to the side plate; these are concealed by the side sheathing, which is shaped to form curved sides for the upper part of the door and window openings. The truss depth is 7 ft., and the fiber stress, under full load, does not exceed 12,000 lbs. per sq. in. in any member.

The center sills are 6-in. channels extending the full length of the car, and spaced further apart than is usual. They do not carry any draft rig-

ging attachment. The drawbar (bent to a flat S-shape) is attached to the bolster, while its lower end projects beneath the end sill and is supported by a yoke. This allows lateral travel sufficient for passing curves of 90 ft. radius. Heavy cast-steel stops riveted to the end sills and rising 8 ins. above the platforms are provided to prevent telescoping in case the underframe of one car should rise and ride upon that of the next car in the event of an accident.

The side and end sheathing is of 1/16-in. steel plate, and this plating is independent of the truss frame, the latter being riveted up complete before the sheathing is put on. The roof is of the monitor type. The doors, seat frames, cushion frames, window guides, etc., are all of steel. The interior sheathing and headlining are of 1/32-in. steel plate. Even the seat covering is of woven metal fabric instead of rattan. The cars are 48 ft. 3 ins. long over the couplers, 12 ft. high and 8 ft. 10⅞ ins. wide over all. Each car has a motor truck with 34¼-in. wheels and 6 ft. 6 ins. wheelbase, and a trailer truck with 30-in. wheels and 5 ft. 6 ins. wheelbase. The trucks are 33 ft. c. to

c., and the motor truck has two 160-HP. motors. The cars were designed by the officers of the railway company. The trucks were built by the Baldwin Locomotive Works, and the bodies by the American Car & Foundry Co. and the Pressed Steel Car Co.

METROPOLITAN ELEVATED RY.—This Chicago road has an experimental steel car, in which the vestibule is a part of the car proper, there being no partition or door across the car at the inner end of the platform. The underframe consists of 6-in. channel side sills connected by 6-in. transverse I-beams, and having end sills and platform sills of 9-in. and 6-in. channels. The posts are angles and I-beams, connected by angle irons forming the top side plate and the belt rail,

LABORATORY TESTS OF THE EFFECT OF STORAGE ON THE VITALITY OF THE TYPHOID BACILLUS IN THE LONDON WATER SUPPLY.

The beneficial effect of storage upon the sanitary quality of water is now well established. A further contribution to the data of the subject has just been made public in the form of a report by Dr. A. C. Houston, Director of Water Examinations, Metropolitan Water Board, London, England.*

Eighteen 4,000 c. c. portions of water, divided equally between the Thames, Lee and New rivers, were infected with from 40 to 8,000,000 typhoid bacilli. At weekly intervals bacterial counts were made until no typhoid germs were found.

In contrast, taking all methods and media tried into account, and testing 1, 10 and 100 c. c. samples, the following results were obtained:

NEGATIVE SAMPLES OUT OF THE 18 PORTIONS.

With 1 c. c. of water.	With 10 c. c. of water.	With 100 c. c. of water.
0 in 1 week	0 in 1 week	0 in 1 week
1 " 2 "	1 " *2 "	0 " 2 "
1 " 3 "	1 " *3 "	0 " 3 "
8 " 4 "	1 " 4 "	0 " 4 "
11 " 5 "	4 " 5 "	4 " 5 "
14 " 6 "	8 " 6 "	7 " 6 "
17 " 7 "	16 " 7 "	11 " 7 "
18 " 8 "	18 " 8 "	16 " 8 "
" "	" "	18 " 9 "

*From one of the original portions no cultures were made until the fourth week.

In water that is to be subjected to filtration, the report brings out anew, preliminary storage

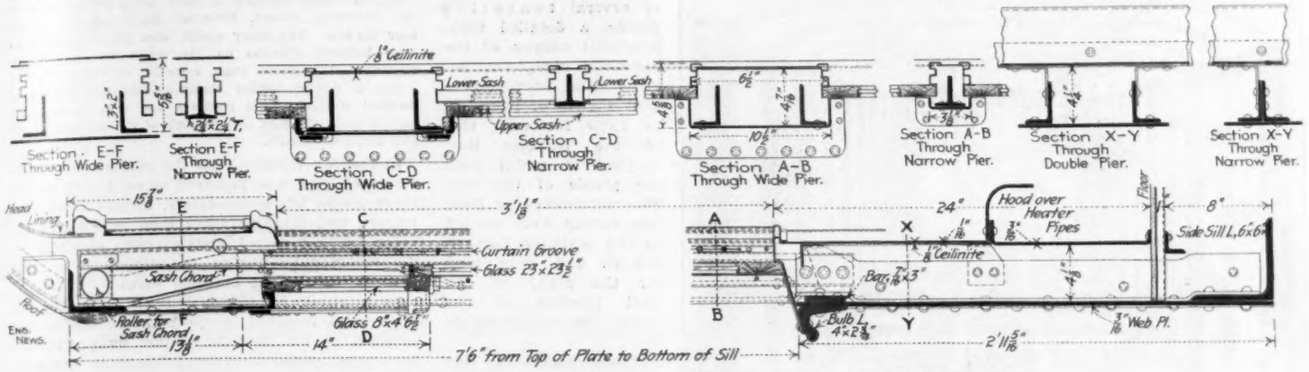


FIG. 12. CROSS-SECTION OF SIDE OF STEEL CAR; NEW YORK CENTRAL RY.

to which the steel sheathing is attached. Longitudinal angles form the upper and lower corners of the monitor deck. The seat frames are of pressed steel and the headlining is of thin steel plates, but the general interior finish is of wood. The car is 47 ft. 6¾ ins. long over the platform sills, and weighs 60,000 lbs. It has seats for 48 passengers.

PHILADELPHIA RAPID TRANSIT CO.—The steel cars have a door in the middle of each side, so that the sides cannot be utilized as plate girders carrying the weight. There are deep fish-belly side sills connected by steel framing, over which is a deck of corrugated steel sheets covered with a cement flooring composition. The sheathing is of steel for the exterior and mahogany for the interior. The cars were built by the Pressed Steel Car Co. They are 49 ft. 7¼ ins. long over the platform sills, and have the trucks spaced 34 ft. 6 ins. apart. They have seats for 52 passengers.

LONDON UNDERGROUND RAILWAYS.—Steel cars are extensively used on the "tube" underground railways of London, England, and some of these cars were built in this country.

STEEL CARS FOR STREET RAILWAYS.

Cars with steel underframes are in use by several electric street railways, and all-steel cars are being introduced. Some cars built by the Pressed Steel Car Co. for the Brooklyn Rapid Transit Ry. are 42 ft. 6 ins. long over the platforms and 31 ft. 6 ins. over the body, with seating accommodation for 48 passengers. The underframing is of 5-in. steel channels, with side plates 5/16 × 18 ins. secured to them by angles. A steel deck is laid upon the framing and covered with a wooden floor. The superstructure framing is also of steel. Each car has four 40-HP. motors. The weight is 50,800 lbs., which is said to be about the same as that of wooden cars of the same size and capacity. Steel-frame cars 50 ft. long have been built.

The Montreal Street Ry. reports that it has had ten steel cars in service for about a year, and that they are giving very good results. The Metropolitan line of the New York City Ry. has 37-ft. steel cars of the closed type. A steel-frame private car for the Los Angeles & Pacific Electric Ry. was noted in our issue of May 25, 1905. One of the London surface electric lines, using a subway for part of its run, has its cars built entirely of steel, including all interior finish, window sashes, etc. A strip of carpet or thin cushion for the seats forms the only upholstering.

Although by employing a variety of culture methods it was nine weeks before tests of as large samples of 100 c. c. were negative for all 18 of the original portions of water, yet this gives no adequate idea of the results of the tests from a practical every-day viewpoint. Thus, by using the same culture medium for the first week-end test as was used to determine the number of typhoid germs used for infecting the water, 1 c. c. samples showed: 100% reduction at the end of one week for the three portions of water infected with 40 germs per c. c.; 99.9% reduction for 13 of the other samples; and 97.8% and 99.7% for the two remaining samples, these two having been dosed with 470,000 germs.

In this same series of tests, 10 of the original portions of water were negative in 3 weeks, 16 in 4 weeks, and the whole 18 in five weeks.

*The Vitality of the Typhoid Bacillus in Artificially Infected Samples of *Raw* Thames, Lee and New River Water, with Special Reference to the Question of Storage.

has a marked "leveling effect" upon the inevitable fluctuations in the bacterial contents of river water. If the storage be of sufficient length, these experiments indicate, the water reaching the filters will be free from typhoid germs and the need for elaborate tests of the effluents from each of the 160 filter beds connected with the London supply would be greatly reduced. Moreover,

it is not impossible that the "safety" of *adequately* stored water may come to be accepted so fully as even to afford justification for filtration through mechanical filters at a specially rapid rate; with a result of thus compensating to a large extent for the initial cost of the storage reservoirs. Doubtless there is much to be said for a policy of preserving all the old filtration safeguards and adding to them the enormous benefits accruing from adequate storage. Nevertheless, I myself am well satisfied that a well-stored rapidly filtered water is likely to be safer than an unstored slowly filtered water.

The chief drawbacks to long storage are (1) capital cost and (2) possible trouble from algae.

As to cost, obviously

a point may be reached beyond which the extra ex-

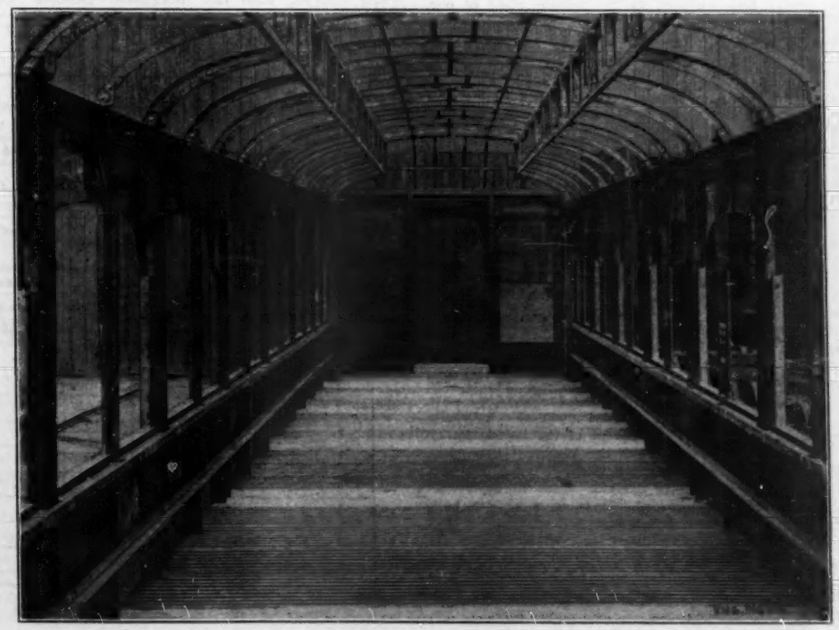


FIG. 13. FRAMING AND FLOOR CONSTRUCTION OF STEEL CAR; NEW YORK CENTRAL RY.

penditure on storage would seem, to an increasing extent, not to be balanced by a commensurate gain in freedom from risk of danger to health.

As bearing on this point Dr. Houston states that experiments in progress indicate that although the Thames and Lee are seriously polluted with sewage, yet they "are safer epidemiologically than could have been supposed in the absence of this *new* and *distinctive* knowledge." Moreover, the mortality of water-borne diseases in London are not appreciably more prevalent than in large cities having unpolluted water supplies. At the same time, the possibilities of outbreaks of typhoid fever on the water supply drainage areas should be borne in mind.

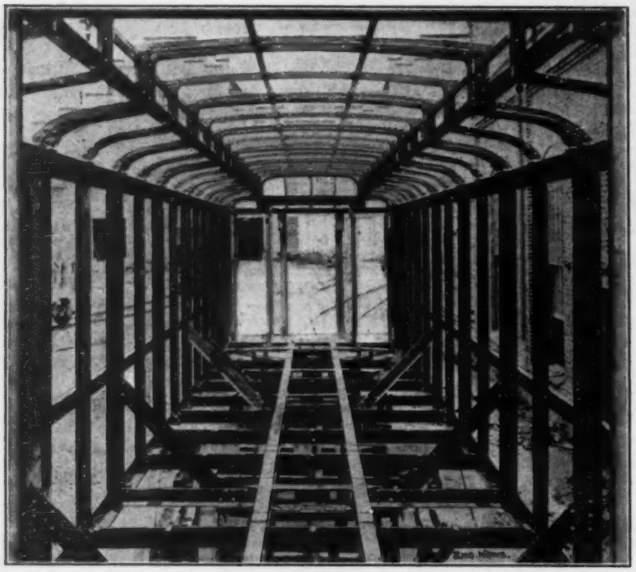


FIG. 14. FRAMING OF STEEL CAR FOR RAPID-TRANSIT SERVICE WITH TRANSVERSE KNEE-BRACES.

(These braces will be concealed in the backs of the cross seats.)

As to troubles from algae likely to arise from long periods of storage, after 57 days nominal storage the Lee water is "very pure bacteriologically and remarkably free from algae growths."

In the way of practical conclusions as to length of water storage Dr. Houston states:

> The advantages accruing from even a few day's storage may be so material that, exceptional cases apart, the use of *raw* unstored water for filtration purposes should strongly be deprecated.
>
> Although as a counsel of perfection a water should possibly be stored for one or two months, storage for four weeks may perhaps, in the present state of our knowledge, be regarded as affording sufficient margin of safety.
>
> The question of storage is one both of quality and quantity and, strictly speaking, the number of days it is *desirable* to store water to improve its *quality* should be added to the minimum number of days of storage which it is necessary to provide in guarding against the possibility of a shortage of water. [It should be remembered that these conclusions are intended to apply to London or similar conditions.—Ed.]
>
> The advantages accruing from adequate storage of water are of a general character and are not confined to the elimination of danger from typhoid fever.

A HYDRAULIC DREDGE to clean out a water-supply reservoir has recently been put in service at the Delecarlia Reservoir near Washington, D. C. This reservoir, about forty acres in area, is fed through a concrete and brick conduit from the Potomac River, some twelve miles distant, and is midway on the system leading to the city. During the past a great amount of silt and mud has washed into the bottom reducing the storage capacity materially. After consideration of various methods for cleaning, the U. S. army engineers, who are in charge of the system, decided upon the hydraulic dredge. This machine, on account of the inaccessibility of the reservoir, was made by the Wetherill Bros. Machine Co. at their works at Chester, Pa., but was shipped knocked down to the site, there to be assembled, launched and equipped. It is on a wooden hull, 66 × 24 × 6 ft. in size, and is equipped with a 10 × 20 × 10-in. compound engine, direct connected to a 10-in. cast-iron special sand and dredging pump having a 10-in. suction and 12-in. discharge pipe. This outfit is capable of delivering 2,300 gals. of water per min. against a 60-ft. head.

STADIA SURVEYS FOR THE LOCATION OF THE CATSKILL AQUEDUCT, PEEKSKILL DIVISION.

By BORIS LEVITT.*

In September, 1905, the Board of Water Supply of the City of New York, began surveys for the location of the new Catskill Aqueduct, which is to furnish the city with an additional supply of water from the Catskill Mountains.

The following is a description of the stadia surveys for the location of a section of this aqueduct, comprising the Peekskill Division, now under construction.

Upon the completion of the reconnoissance surveys for the location of several tentative routes, a detailed topographical survey of the approved route was begun. The survey covered a strip of from 300 to 1,000 ft., each side of the traverse line, varying in width with the profile of the line. The maps resulting from this survey were plotted to the scale of 1-in. = 100 ft. and were used for the study of the final location of the center line of the aqueduct.

Before beginning this survey, some improvements in the stadia methods were considered. Experiments were made with a view to devising a method which would eliminate many of the errors in observing and recording, by arranging the order and number of observations in such a way as to make each step to be a check on the next one and in this way make the work check automatically.

After some experimenting a method was adopted which to a large extent accomplished the desired result.

In the instructions to the field party the following was required at each transit station for the location of the base line traverse; two readings for distance on each of the two intersecting courses of the traverse, two readings for each vertical angle, the horizontal angle between the intersecting courses, and the azimuth of the forward course, also the magnetic needle. This gave four readings for the distance on each course and four readings for each vertical angle, the average of all, in each case, being used.

To accomplish this four separate steps were required, a record of which is given by the first four lines of the notes.

The successive steps in detail were as follows:

Transit centered over the station.

Step 1. Plate clamped at zero, telescope pointed to the back station. The *upper* stadia wire made to cover an even hundred division on the stadia rod and separate readings for each of the three wires recorded, and the vertical angle.

Step 2. Lower motion clamped, telescope pointed to forward station, the stadia readings and vertical angle recorded as in (1) also the horizontal angle between courses.

Step 3. Plate clamped to read the back azimuth of the preceding course, telescope again pointed to the rear station. The *lower* stadia wire made to cover an even hundred division on the stadia rod, the stadia readings and vertical angle recorded as before.

Step 4. Lower motion clamped, telescope pointed to forward station, stadia readings and vertical angle recorded as in (3) also the azimuth of the forward course and magnetic needle.

In reading distances on the stadia rod the instrument man was required to read each of the three stadia wires separately, instead of the intercept, and these readings were recorded in the notes. The required distance was obtained by the recorder by taking the difference between the readings of the extreme wires.

As a check on the instrument man the recorder was required to check the reading of the azimuth of the forward course by adding the horizontal angle, already obtained, to the back azimuth of the preceding course, and to see that they are nearly equal as proof that no error was made in reading the distance by taking the differences between the readings of the middle and extreme stadia wires.

It was expected in adopting the above method that the recorder by applying these checks would be able to detect serious errors and have them corrected before the instrument was moved away from the station.

The work of locating the traverse line completed, the work of taking side shots for the topography was begun. In taking side shots distances were read only once and directly off the stadia rod by intercepts. In the note book each shot was numbered consecutively at each station, and described by means of a code of single letters previously prepared, and furnished with each note book. In addition each shot was distinguished by the initial letter of the rodman's name.

Field notes were kept in a loose leaf notebook on a form specially adapted for the work. The loose leaf notebook was found to be very convenient not only for filing purposes, but also for the reason that the notes at the end of a day's

*Assistant Engineer, Board of Water Supply, City of New York, Peekskill, N. Y.

LOCATION Courtlandt-Township Westchester Co. FILE NO. 3 PAGE NO. 368
G.R. Recorder J.C.G. INSTRUMENT MAN Dec. 18 1905

	OBJECT	AZIMUTH	MAGNETIC	STADIA	DISTANCE	V. ANGLE	HOR.	VERT.	ELEVATION
				At Sta. △147		Ht. Instr. 4.11			182.04
	△146	0-00		100 441 447	741	+4-43			
	△148	218°-37'		100 490 495	790	-4-00			
	△146	152°-59'		000 426 430	741	+4-43			
	△148	11°-36'	N12°-41'E	000 498 503	790	-4-01			
	B.M.	82°-30'		000 476 481	632	+1-06			194.10
	Ch. Az.	26°-06'							
W1	C.S.	11°-55'			318	-6-41			
B2	W.I.	84°-32'			612	+1-06			
W3	W.F.	357°-35'			266	-4-46			
B4	C.S.	77°-15'			660	+0-42			
W5	I.R.F.	39°-16'			210	-6-40			
W6	I.R.W.	339°-15'			255	-2-00			
B7	C.S.	137°-14'			103	-3-33			
W8	I.R.W.	119°-27'			112	-2-03			

FORM NO. 43 E. STADIA

VALUABLE. BOARD OF WATER SUPPLY, 299 BROADWAY, NEW YORK CITY. RETURN

FIG. 1. PAGE OF NOTES USED IN STADIA SURVEYS OF CATSKILL AQUEDUCT.

work could be detached from the book and left in the office to be worked up, instead of waiting until the whole book is filled as would otherwise be the case.

Bench marks were set in advance by a level party and readings were made upon these bench marks in the same way and with the same degree of care as upon a transit station.

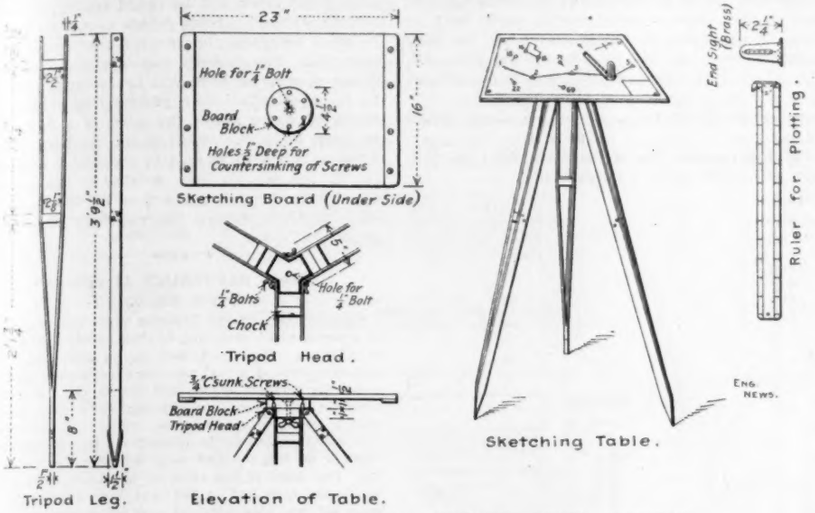


FIG. 2. PORTABLE SKETCHING TABLE FOR STADIA SURVEYS.

The stadia rods used were 12½ ft. long by 4½ ins. wide by ⅛-in. thick. A stiffening rib 10½ ft. long, 3½ ins. wide and ⅛-in. thick, beveled towards the ends, was screwed on the back. Iron shoes, made of strap iron, about ⅛-in. thick, were screwed to the top and bottom of the rod. The rods were marked into feet and tenths, graduated to suit the instrument and painted, by the field party. The diamonds on the rod were painted in black on a white field, later changed to a deep blue on a yellow field. The first foot mark was 6 ins. from the bottom, and the twelfth even with the top of the rod. The diamonds at the fifth and tenth foot had a Roman V and X painted in red across the diamond. (Fig. 4.)

SKETCHING TABLE.—Excellent field sketches of the topography were made in the field on a portable sketching table which the party carried with them. These sketches were plotted to scale and were an immense help in the preparation of the maps. The sketching table was designed by Mr. Leicester Durham, Assistant Engineer of the Board of Water Supply, and was made by a carpenter from a drawing prepared in the office. It consisted of a sketch board 16 × 23-in. supported on a tripod, and so constructed that it could be revolved in azimuth and clamped in position by means of a wing nut under the head of the tripod engaging a bolt attached to the under side of the board and passing through a hole in the center of the tripod head. A 12-in. flat engineer's scale, graduated twenty parts to the inch, with a vertical sight attached at one end and a peg at the other served both as a scale and instrument for direction. On one side of the ruler at the zero point of the scale, a notch in the projection of the bottom plate of the vertical sight provided a point at which the ruler could be rotated around a pivot as a center, the pivot being a pin stuck in the paper and marking the transit point from which the work proceeded. (See Fig. 2.)

In use, the table was set up a few feet from the transit and oriented by placing the ruler on the line of the previous course, already on the paper, and turning the top of the table until the rod held on the preceding station could be seen through the vertical sight of the ruler and in line with the peg at the other end of it. The top was then clamped and the table was oriented. When the transitman had sighted on the forward station and called off the horizontal angle and distance to the recorder, the sketcher by means of a small protractor plotted the forward course, scaled off the distance and marked the point to be used as his next set up. In plotting the side shots the sketcher followed the operations of the transitman and got the direction for each shot by pointing his ruler to the rod. As the transitman called off the distance the sketcher plotted it to scale (1-in. = 200 ft.) and by means of a little circle around the dot and a dash along the edge of the ruler, indicated both the point and the direction from which the shot was taken. He also numbered each shot to correspond with the number of the same shot in the recorder's notes, checking up these numbers with him at intervals of each ten or fifteen shots. The numbers of the shots on the sketch and in the field notes had to correspond to make the sketch useful to the draftsman.

Before leaving the station the sketcher connected the different shots taken along roads, brooks, fences, walls, at corners of buildings, etc., and sketched these in by using topographic symbols. He then sketched in enough contour lines to indicate the general profile of the country, and added other information given him by the chief of the party and rodmen, such as names of owners, nature and condition of buildings, cultivation, etc.

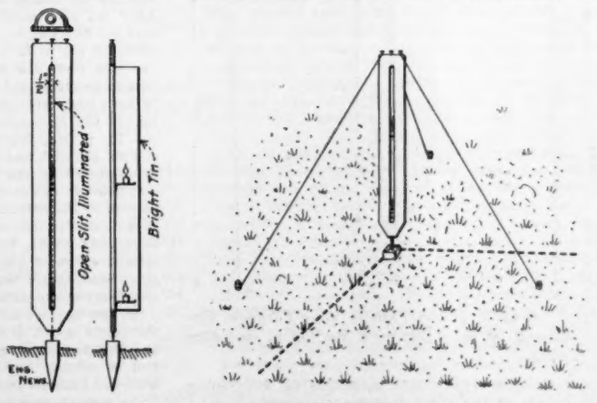


FIG. 3. ILLUMINATED TARGET USED FOR POLARIS OBSERVATIONS.

The sketch while in progress was of immediate use to the chief of party as a progress diagram of the field work. By consulting the sketch at any time he could tell at a glance just how much of the work had been done, fill in such portions of the area as may have been overlooked, and prevent overlaps in the work.

No delay was occasioned by the sketcher taking time to sketch in the topography, as he generally got enough time between shots to do much of the sketching and completed the rest while the instrument man was engaged in setting up his instrument and taking readings for the base line traverse. The sketching was mostly done by the chief of the party himself, relieved when necessary by some one of the party who could be spared for a time. No additional man was employed as sketcher.

In the office all the notes were reduced as soon as they were brought in by the field party, the co-ordinates of all transit points computed, and the maps plotted. All distances and differences of elevation on the traverse line were reduced from printed tables, and all side shots were reduced by diagram or slide rule.

In the preparation of the maps the field sketches were used as follows: The first operation was to plot on a sheet the traverse line and the side shots only, as many as would go on the sheet, paying no attention to the description of the shots. The transit points were plotted by co-ordinates, and the side shots with a protractor. Each side shot, as plotted from the field notes, was marked with its number and elevation. The draftsman, then, instead of plotting the surface topography from the field notes, which is a slow and tedious operation, took up the field sketch covering the same area and reproduced the topography shown on the sketch by identifying and connecting the corresponding side shots on the map.

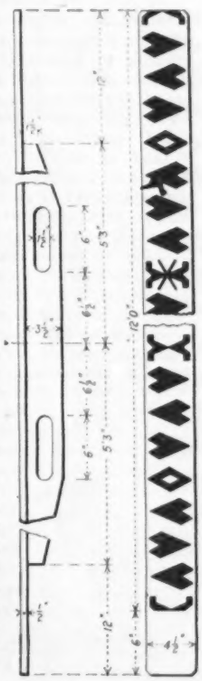


Fig. 4. Stadia Rod Used on Catskill Aqueduct Survey.

The map once started, the side shots were easily located on the field sketch by their numbers and relative position to the same transit points. In this way, plotting the surface topography consumed the least amount of time in the process of preparing the maps. Contours were interpolated between the side shot elevations at five foot intervals, using the field sketches as a guide.

Any errors in the field notes were generally detected by the unreasonable position of some side shot as plotted from the notes, and such were immediately tested by applying a protractor and scale to the field sketch and corrected. Between the field notes and the field sketches very few errors of any consequence were found which could not be corrected without sending the party out in the field.

In the course of the work frequent Polaris observations for azimuth were made. These were nearly all time observations, that is, the star was observed in its path between elongation and culmination and the exact time and azimuth when the star was covered by the instrument recorded in the notes. The horizontal angle between the star and the course was observed in one operation and to do this quickly a simple illuminated target (Fig. 3), was set up over the forward station. The target was centered over the station and held in place by three stay strings. The illumination was furnished by two candles be-

hind a narrow slit in the target. A piece of tracing cloth pasted over the slit made the light appear uniform and continuous. Six to eight observations, in sets of two, were made at intervals of a few minutes. The observations were reduced by using a table prepared by the U. S. Land Office.

The Peekskill Division is a part of the Northern Aqueduct Department and is 13 miles long. Mr. J. Waldo Smith is the chief engineer of the Board of Water Supply, Mr. Robert Ridgway, Department Engineer of the Northern Aqueduct Department, and M. A. A. Sproul, Division Engineer of the Peekskill Division. The division is located between Hunters Brook in Westchester County, and Foundry Brook in Putnam County, and is in general direction parallel with the Hudson River. The southerly end of the division is about 4½ miles east of the village of Peekskill on the Hudson, the first quarter point from Hunter's Brook is about 2½ miles from Peekskill, and from there in a generally straight line to a point about 1¼ miles east of the Village of Cold Spring on the Hudson.

D'OCAGNE'S* METHOD OF ISOPLETHE POINTS APPLIED TO THE FRANCIS WEIR FORMULA.†

By RICHARD MULLER.‡

As regards rapidity in calculations it has been often observed that graphical methods are far superior to numerical methods. Not only does the graphical method save time and labor, but it practically eliminates gross errors.

The particular graph which we have here under consideration is based on the ingenious method of isoplethe points, developed by M. d'Ocagne. The principle that this mathematician has established is so elegant and yet so simple, that an explanation of it will undoubtedly be appreciated, and at the same time prove the correctness of the graph of the Francis formula shown in Fig. 2, which has been developed by this method.

Assume a system of rectangular coordinates, as shown in Fig. 1. Let AB and CD be two lines parallel to the Y-axis and call their interceptions with the axis of x, a and b, respectively.

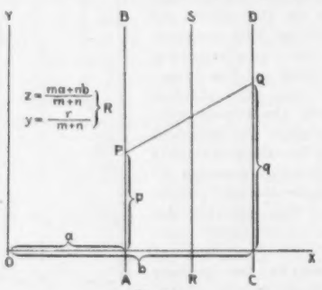


Fig. 1.

Assuming two points P and Q, representing a variable nature whose ordinates are p and q, if such two points satisfy the relation $mp + nq = r$ (m, n and r remaining constant), the line PQ revolves about a fixed point, R, whose coordinates (x, y) can be determined without difficulty.

Effectively, R may be regarded as the point of application of the resultant of two parallel forces whose moments are:

$$mp + nq = (m + n)\ y,$$
$$ma + nb = (m + n)\ x,$$

taking moments about OX and OY, respectively. If we solve these two equations with respect to x and y we find

$$x = \frac{ma + nb}{(m + n)} \quad (1)$$

and

$$y = \frac{mp + nq}{(m + n)};$$

but $mp + nq = r$, therefore $y = \frac{r}{(m + n)}$ (2)

Expressions (1) and (2), as is readily seen, are independent of p and q, and if r alone varies, m and n remain constant.

Therefore R is a fixed point in the first case, and in the other, a point moving such that its locus is a parallel to the given lines. We may conclude, then, that if we plot on the lines AB, CD, RS, points whose ordinates will be proportional respectively to p, q, $\frac{r}{m + n}$, these values satisfying an equation of the form $mp + nq = r$, such points will be in a straight line.

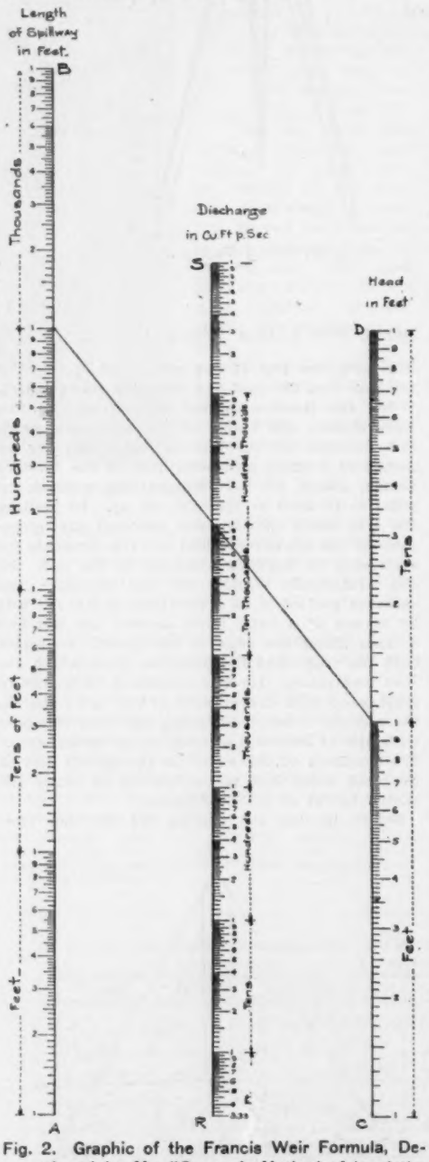


Fig. 2. Graphic of the Francis Weir Formula, Developed by M. d'Ocagne's Method of Isoplethe Points.

Let us now apply this principle in developing the graph of the Francis formula

$$Q = 3.33\ L\ H^{\frac{3}{2}}$$

This expression may be transformed to the logarithmic equivalent:

$$log\ Q = log\ 3.33 + log\ L + \frac{3}{2}\ log\ H$$

which is identical with the normal form; as

$$log\ Q = r;\ log\ L = mp;\ \frac{3}{2}\ log\ H = nq;$$

log 3.33 is a constant, K.

In this case, however, the graduation on the parallel lines will not be proportional to the variables, but to their logarithms. The work of plotting these is laid out as shown by Fig. 2. It is manifestly clear, that with the help of this graph two values of the Francis formula being known the other will be found readily, and by a "single stroke," a thing which cannot be realized in most diagrams, or graphic representations of formulae. The rapidity and ease with which this diagram may be used will be better appreciated by its application to a practical example. The depth of water above the crest of a dam 1,000 ft. long, is 10 ft. What is the discharge? Join 1,000 on AB with 10 on CD, and find Q = 105,000 cu. ft. per sec. on RS. Solving in the ordinary way by the formula gives Q = 105,250 cu. ft. per sec., thereby proving the accuracy of the diagram.

TRACK MAINTENANCE AT CURVES.*

By DR. HEUBACH.

Measurements on the Bavarian State Rys. were taken at a curve, which according to plans should have a radius of 1,148 ft. The object was, (1) to make comparative measurements of actual curvature by method of measuring the versines of the arcs and by the Reiss curve-measure; (2) to ascertain why this curve, particularly in places, gave unusually great trouble in maintenance and was correspondingly expensive. The superstructure consists of 29½-ft. steel rails weighing 70.29 lbs. per yd. The wear of the sides of the heads of the rails, which had been laid in 1903 and were accordingly four years old, was also measured; also the superelevation and the gage. The following conclusions may be drawn:

(1) The points which gave special trouble in maintenance showed considerable deviation from the true curvature. The radius varied between 977 ft. and 1,443 ft., according to the measurements taken by the versine method, and between 934 ft. and 1,902 ft., according to the measurements made with the curve-measurer.

(2) The points which were more easily maintained, showed much smaller deviations from the true curvature. The radius varied only between 1,016 ft. and 1,279 ft.

(3) These measurements confirm the correctness of the recommendations (see Zentralblatt der Bauverwaltung, No. 12 of Feb. 6, 1907) that greater attention should be paid to the position of rails at curves, and that more measurements should be taken, but that the really necessary degree of accuracy should not be exceeded.

The results of these measurements, particularly those obtained on the more easily maintained points, give a clue as to what degree of accuracy is really necessary. For they show that variations of from 8% to not more than 10% from the correct radius are not of real importance, and that it would be rather useless to adjust and maintain the curvature more accurately.

There is also another reason why such scrupulous accuracy is unnecessary; for from the point of view of the German railway regulations it is not very important whether the radius of a curve is 1,476 ft., 1,640 ft., or 1,804 ft., as the speeds specified for these radii vary between 48.2 and 51.3 mi. p. hr. The real points of importance are to have the curvature moderately uniform (so that there are no sudden transitions from a small to a large radius and vice versa), and more especially not to have such large errors as are bound to occur, according to the statements of Hansen and Bräuning (1907, No. 33, p. 523; Zentralblatt der Bauverwaltung, No. 14 of Feb. 14, 1906, and No. 12 of Feb. 6, 1907) if the curves are adjusted by eye only.

Systematic observations will perhaps lead to the reduction of the now-accepted admissible error of 8 to 10%. If we consider that according to Hansen and Bräuning's statements tracks, which were carefully adjusted by eye, showed errors of 230, 40, 27 and 45% in the radius, we must admit that a limit of error of 8 to 10% is already a considerable improvement.

(4) The conclusions so far mentioned, only touch upon the points which are important as regards maintenance and traffic, that is to say, which chiefly affect the question of safety. But the matter is also very important from the financial point of view.

The measurements of the wear of the side of the railhead showed very clearly that there is a very close connection between errors in the curvature (radii too small) and unusually large wear of rail. At points where the radius is much too small the wear is two or three times greater than it is on the section where the curvature is more correct. This leads to the important conclusion that errors of this kind may result in reducing the life of the superstructure to 50% or even 33% of what it would be if the curvature was correct.

*Condensed from a paper in "Zeitung des Vereins Deutscher Eisenbahnverwaltungen," as translated and printed in the August "Bulletin" of the International Railway Congress Association."

*Maurice d'Ocagne, Professor at the Ecole des Ponts et Chaussées, Paris, France.

†$Q = 3.33\ L\ H^{\frac{3}{2}}$

‡With Viele, Blackwell & Buck, Consulting Engineers, 49 Wall St., New York City.

TESTS OF "SMOKELESS" BOILER SETTINGS AT CHICAGO.

The campaign against smoke production in Chicago has led to some controversy between the Smoke Inspection Department and the Board of Education as to the boiler setting which the latter has been using for some years and which was designed by Mr. T. J. Waters, Chief Engineer of the Board. This setting is shown in Fig. 1. The Smoke Inspection Department claimed that for years the school houses, where soft coal was used with horizontal tubular boilers, have been among the worst offenders. The city ordinance establishing the Smoke Inspection Department makes it necessary for any one installing a boiler first to have the plans approved. Permits were refused for the installation of boilers according to the standard design of the Board of Education.

During the Christmas holiday, one boiler in the Feisenthal school was equipped with a brick arch or roof covering the grates. (Fig. 2.) This setting was designed by Mr. P. P. Bird, Smoke Inspector. The department suggested that this boiler be so equipped, not because it considered that the equipment would represent the best that could be done, but as in the few days available the arch could be put in and results observed.

At the time of the change nothing was said of the comparative efficiencies of the arrangements, the only attempt being to decrease the smoke emitted. Even this change made was not claimed as what would be permitted in new work where the boiler is required to be set much higher than has heretofore been the practice, so that a larger furnace may be obtained in which to burn the highly volatile local coals.

Tests were made on the two boilers (one old standard setting and one with an arch) by Collins & Stevens, engineers. An extract of their report follows:

TEST OF JAN. 6.—During the first hour, the smoke emitted was considerable for a short interval immediately after firing. In neither case was very black smoke given off for more than a few seconds. On the remainder of the test, the Waters setting was operated with very little smoke at any time. It was necessary to clean the fires three times during the test of the firebrick-enclosed furnace against one cleaning of the Waters setting. This cleaning was the cause of a considerable loss of efficiency and also was conducive to the production of smoke as well as being of serious consequence in the reduction of the steam pressure to a point where it was necessary to shut down the engine.

TESTS OF JAN. 11 AND 12.—The smoke in neither case was objectionable at any time. Both settings smoked somewhat during the first hour. Results show that about 175 lbs. more wood were required by the firebrick enclosed furnace to produce steam at the start. This heat was no doubt absorbed by the brickwork, to be given off gradually after the plant was shut down.

The Smoke Inspection Department claims, on the one hand, that these tests are not to be taken as indicative of the expected performance of a "smokeless" design which it would approve. On the other hand, it claims also to have made no pretentions about the efficiency of tubular boilers used with soft coal as it is interested in smoke prevention only. The records of observations made (using the Ringleman system) show slightly less smoke with the low-arched firebox than with the standard design of the Board of Education, although, with the expert firing during the test, neither smoked seriously. Such expert attention could not be expected with either setting in ordinary practice.

The Smoke Inspection Department further claims that the smoke problem is of sufficient importance to warrant buying larger boilers, if necessary, to make the same amount of steam, and in using more coal, if necessary, to evaporate a given amount of water in order that it may be done without making smoke. While it is not believed that with a properly-designed boiler setting it will be necessary to burn more coal or to use a larger boiler, yet the department claims that the expenditure would be justified if this were the only way that smokeless stacks could be obtained.

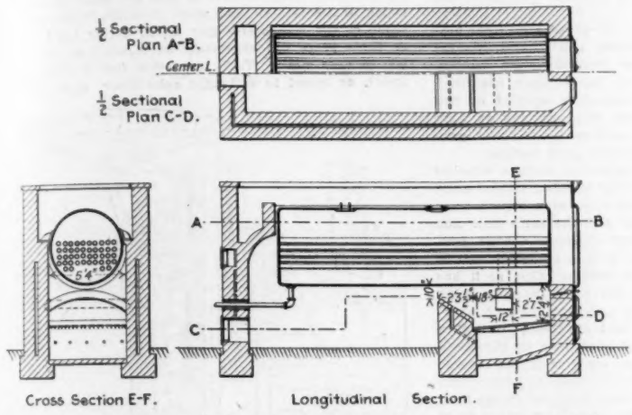


FIG. 1. STANDARD BOILER SETTING AT CHICAGO SCHOOL BUILDINGS.

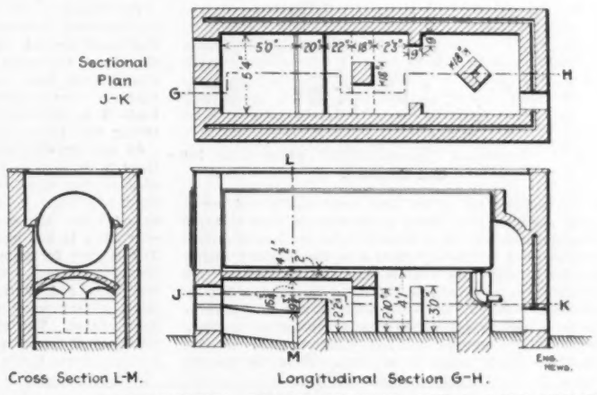


FIG. 2. EXPERIMENTAL BOILER SETTING WITH LOW-ARCHED FIRE-BOX.

RESULTS OF TESTS:
BOILER SETTINGS WITH AND WITHOUT LOW-ARCHED FIREBOXES.

	Jan. 6.		Jan. 11, 12.	
	Waters.	Bird.	Waters.	Bird.
Coal to raise steam	75 lbs.	75 lbs.	100 lbs.	100 lbs.
Wood to raise steam	800 lbs.	1,200 lbs.	475 lbs.	650 lbs.
Time to raise steam	1 hr. 25 min.	1 hr. 45 min.	1 hr. 6 min.	53 min.
Effic. of boiler and grate	64.82%	57.75%	....	....
Evap. per lb. of coal (actual)	6.180	5.405	75.638	4.985
Evap. per lb. of coal from and at 212° F.	7.463	6.503	....	....
Cost to evap. 1,000 lbs. feed water	16.16 cts.	18.50 cts.	17.73 cts.	20.06 cts.
HP. developed	104.1	117.8	94	96
Smoke	....	....	Slight.	Slight.

OVERHEAD RAILWAY CROSSINGS in the city of New Bedford have two unusual features. They are of the rather common pony through plate-girder type, with columns at the curbs so as to make three spans, a long one over the roadway and two short spans over the two sidewalks. Ordinarily the main girders are carried over all three spans, from abutment to abutment. At New Bedford, however, the main girders terminate over the columns; the sidewalk spans are formed of the track stringers only. The girders do not seat on the columns direct, but on a shallow, heavy box girder extending over all the columns of the bent. Crossed diagonal bracing between adjacent columns below this box-girder completes the bent. The second unusual feature of these crossings is the use of an ordinary open floor (wooden cross-ties or stringers) covered with 2-in. plank to protect the street and sidewalks from droppings of oil, ashes, etc. For further protection a canopy extends over the sidewalks. This work is described in a paper by Mr. W. F. Williams in the July issue of the "Journal of the Association of Engineering Societies." The bridges were designed by the bridge department of the New York, New Haven & Hartford R. R. Co. Mr. B. T. Wheeler is in charge of the construction for the railway company, and Mr. J. F. Keon was in charge for the contractor, J. K. Ryan.

A COMBINATION CONCRETE BLOCK AND REINFORCED CONCRETE BUILDING.

By L. A. WATERBURY.*

In the construction of a new dormitory for Pomona College, at Claremont, Cal., there is a somewhat novel feature in the use of reinforced-concrete columns cast in the hollow concrete blocks of which the side walls are composed. The typical blocks are 12 ins. wide, 12 ins. deep and 24 ins. long, with two vertical cores, 8 ins. square, in each block. In laying the walls the blocks are so placed as to form a continuous vertical opening at each column. When the wall for one story has been completed the reinforcement for the wall columns is lowered into place, in the openings which have been made for this purpose. The reinforcement for each of these columns consists of four vertical rods, together with a spiral of heavy wire. The vertical rods are of such length that when the reinforcement is in place the top will project at least 2 ft. into the columns of the story above. The ends of the rods, at the top of each column, are wired together so that they will not interfere with the reinforcement for the story above, when it is lowered into place. Before the wall columns are cast a hole is broken into the block at the bottom of each column, to permit the removal of chips and dirt. This hole is closed by a board wired to the steel within. After the column has set, the board is removed and the wires are cut close to the concrete.

At the top of each story there is a reinforced-concrete band, forming part of the wall, and extending entirely around the building. The concrete slab of the floor above forms the top of this band, so that the band forms a girder supporting the floor. If the blocks were entirely removed this girder and the wall columns would be sufficient to support the adjacent floors. The building thus has a complete reinforced-concrete skeleton.

The interior columns are each reinforced with six longitudinal rods and a heavy spiral. For these columns two longitudinal rods are continuous at each floor, and the other rods have joints with pipe sleeves.

There are two reinforced-concrete cross walls which divide the building into three parts. There are also reinforced-concrete walls adjacent to the stairways. With these exceptions the partition walls are formed of metal lath plastered on both sides to form solid walls 2 ins. thick. The bases and the floor finish are made of cement mortar.

The block walls will be plastered on both sides. The plaster used for the exterior will be a Portland cement mortar, with a small percentage of lime.

The architects for the building are Myron Hunt and Elmer Grey, Union Trust Bldg., Los Angeles, and the contractor is Richards-Neustadt Construction Co., also of Los Angeles.

*Professor of Civil Engineering, University of Arizona, Tucson, Ariz.

THE GOVERNING AND SPEED VARIATIONS OF GAS ENGINES.*

By JAMES ATKINSON,† M. Inst. M. E.

The continuous increase in the size of gas engines and the widening field for their employment have necessitated various modifications in their design and methods of operation, the question of their regularity of turning and closeness of governing being by no means the least important causes of these modifications. It is very usual to hear remarks made as to the irregularity

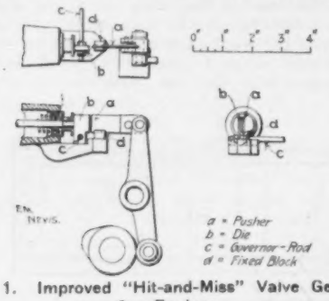


Fig. 1. Improved "Hit-and-Miss" Valve Gear for Gas Engines.

of gas engines, as though they were usually and necessarily more irregular than steam engines, such remarks being very unfair. It is true that the cyclical variations of speed may be slightly greater in the ordinary single-cylinder "Otto" gas engine than in the case of the ordinary steam engine; but the mean variation is usually considerably better, and even with hit-and-miss governing such engines are amply steady enough for ordinary shop driving, pumping and the great majority of purposes for which power is required. Even for electric light driving, ample steadiness can be obtained by using a sufficiently heavy fly-wheel.

Methods of governing gas engines may be divided into two classes. In the first class the volume of the charge remains constant and sufficient to fill the cylinder as nearly as possible at atmospheric pressure, but the proportion of gas to air is varied according to the load. In the second the proportion of gas to air is kept approximately uniform, but the volume of the charge is varied either by closing the admission valve before the end of the suction stroke or by throttling; the result in either case being a charge sufficient to fill a part of the cylinder only at atmospheric pressure. The first method is commonly called the quality method and the latter the quantity method.

The most desirable arrangement to use depends to a large extent on the size and type of engine, also the kind of gas employed. It is desirable to use the quality type with engines having any considerable weight of reciprocating parts attached to one connecting-rod, because under these circumstances the inertia of the reciprocating parts should be cushioned by the compression pressure in the cylinder at the time of ignition, otherwise shock may be caused similar to that in a steam engine working with insufficient compression or lead. Either the quality or quantity method is applicable to engines having only one piston attached to the one connecting rod and running at a moderate speed, as under these circumstances the reduced compression pressure is sufficient to take up the inertia forces and to prevent shock at the time of ignition. When some kinds of producer gas are used it is necessary to have governing appliances which are not liable to be upset by a little tar or dust in the gas.

The quality method may be subdivided into hit-and-miss governing, variable gas admission uniform during the suction stroke, and variable gas admission caused by opening the gas-valve earlier or later during the suction-stroke but always closing it at the end of this stroke, the contents of the cylinder when reduced loads are being carried being to some extent stratified, air being next to the piston and a rich mixture drawn in last, remaining near the firing point.

The quantity method of governing may be divided into throttle governing and cut-off governing. With one or two unimportant exceptions all types of governing are included in the above.

For many years hit-and-miss governing was universally and exclusively employed, and it still remains the usual method for small or moderate sized engines. So far as the author is aware, its economy has practically never been excelled, being only equalled on full loads by very carefully arranged methods, and on light loads it is still necessary to combine hit-and-miss governing with other methods to obtain such results.

As usually constructed the governor decides whether there is to be a hit and a miss by the fact of one knife edge passing on one side or the other of a second knife edge, practically by a hair line and the same hair line on all loads; the governor itself therefore always governs when in one position, and it does not much matter if it is very far from being isochronous; also, as it has very little actual work to do, the parts to move being very light and having scarcely any resistance to overcome, a very small governor will effectually control a large engine. The closeness of governing or the mean variation of speed on varying loads with an engine having a fairly heavy fly-wheel can easily be kept within 2% from full load to any load. Most gas engines fitted with hit-and-miss governing are so arranged that if the engine pulls up on the load from any cause, the operating gear for opening the gas valve is drawn out of contact as the engine slows down and before it stops, thus the engine cannot stop with the gas valve open. This precaution is absolutely necessary for the safety of engines liable to be left for long periods by the attendant, and drawing their air charges from the engine room.

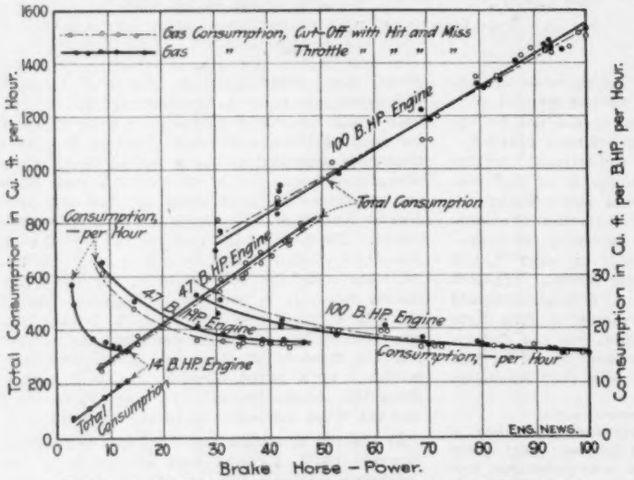

Gas Consumption, Cut-Off with Hit and Miss
Gas " Throttle " " " "
Total Consumption in Cu. ft. per Hour.
Consumption in Cu. ft. per B.HP. per Hour.
100 B.HP. Engine
Total Consumption
Consumption, per Hour
47 B.HP. Engine
14 B.HP. Engine
Brake Horse-Power.
ENG. NEWS.

FIG. 2. GAS CONSUMPTION OF ENGINES GOVERNING BY "HIT-AND-MISS" AND BY "THROTTLE" METHODS.

The ordinary hit-and-miss gear is well known, but a recent improvement may be described. It is shown in Fig. 1 and consists in allowing the blade of the pusher a small amount of side play at right angles to the line of thrust, so that the knife edge may always find the bottom of the V in the die in whatever position the latter may be held in the governor rod. When disengaged, the blade rests in the V of the fixed block and naturally slides to the bottom thereof, thus returning to its proper position should it have been deflected sideways by the motion of the die. The deflections, without this improvement, though small, often cause corresponding movements of the governor, and occasionally nibbling or partially opening and sudden flying back of the gas valve, accompanied by needless wear and tear, objectionable noise and sometimes irregular explosions in the cylinder.

There is a tendency in some quarters to belittle hit-and-miss governing, but for many purposes, especially in small engines, it still remains the most suitable arrangement, and it is advisable to give due weight to the solid and substantial advantages it offers before substituting other arrangements.

Fig. 2 shows some consumption lines for engine governing by hit-and-miss. The full lines give the consumption per B.HP. per hour, and the total consumption per hour. It is interesting to note that the fuel-consumption-per-hour lines are practically straight, being in this respect similar to what is known as the "Willans" line of steam engines. It is unfortunate that the particulars given in these and in other tests are comparable only with themselves and not with each other, owing to the constant and great variation in the calorific value of the Manchester gas, which during the last two or three years has constantly fluctuated from less than 500 to over 600 B. T. U. per cubic foot (on the lower scale), as tested in a Junker calorimeter, often varying

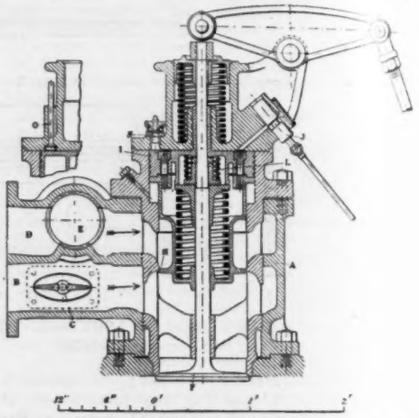
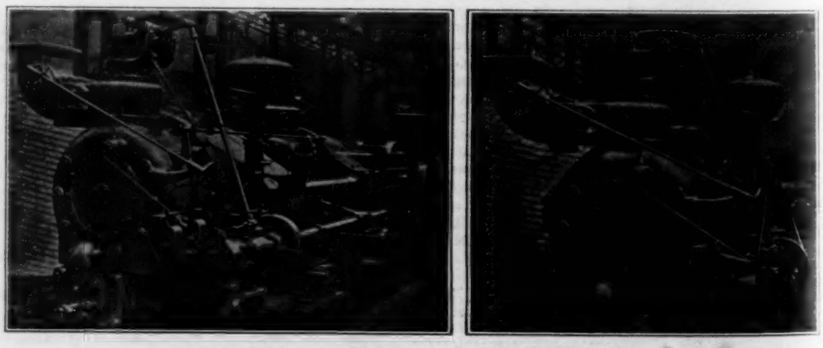


Fig. 3. Governing Gear for 500 HP. Gas Engine.
Recently constructed and tested by Crossley Bros., Ltd., Manchester, Eng.

A to main casting.	H gas valve.
B air connection.	I vacuum piston.
C throttle valve.	J cylindrical plug.
D gas connection.	L buffer spring.
E gas cock.	N snifting valve.
F admission valve.	

30 or more units during a test and larger amount from day to day. It will be seen that these tests are for three different-sized engines, the smallest giving about 14 brake-HP. as a maximum, the next in size about 47 brake-HP. and the largest 100 brake-HP.

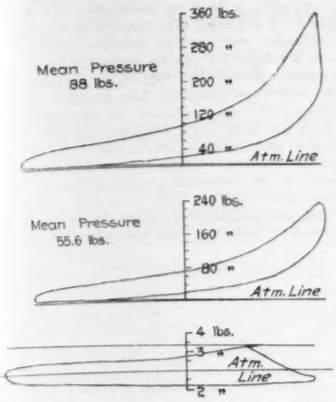
Quality governing by admitting the gas in varying quantities continuously throughout the suction stroke is not generally adopted, though some very large engines have been controlled in this manner. The extent to which variation in richness of the mixture can be carried out in this way is somewhat limited. If the charge is either too rich or too weak it will not ignite freely but will burn slowly, and in either case a point is very soon reached when it burns so slowly as to continue still inflamed during the whole of the exhaust-stroke, and until the commencement of the suction stroke, when the fresh charge drawn into the cylinder is fired by the smoldering flames still lingering there and an explosion takes place while the admission valve is still open, resulting in burnt products being driven into the air and gas mains, sometimes causing the next or second charge to be vitiated so that two full working strokes are occasionally spoiled in this way.



FIGS. 4 AND 5. GOVERNING GEAR ON TANDEM ENGINES OF 500 TO 600 HP.
Crossley Bros., Ltd., Manchester, England, Builders.

*An abstract from a paper read at a meeting of the Institution of Mechanical Engineers, London, April 10, 1908.

†With Crossley Bros., Ltd., Manchester, Eng.



Figs. 6, 7 and 8. Indicator Diagrams Taken From Engines Fitted with Governing Gear shown in Fig. 3.

When the engine is always working on full load, or almost full load, this method of governing can be used successfully, but for engines which have to govern throughout the full range of work from full load to no load it is not satisfactory. It has, however, the advantage of simplicity. A very common arrangement is to have two throttle valves, one in the air main and one in the gas main, controlled by the governor which closes one as it opens the other and vice versa. As these throttle valves can be arranged to be in equilibrium, the governor need not be very powerful. In small or medium-sized engines the addition of a gas valve and hit-and-miss governing, to come into operation so as to miss occasionally when the engine is running below half load, makes a great improvement to this type of governing, by preventing the irregularities which might otherwise occur on these light loads and also the excessive gas consumption. Unfortunately hit-and-miss governing is scarcely suitable for large engines, owing to the inadvisability of opening a large and necessarily heavy gas valve by means of a knife edge.

Variable gas admission caused by opening the gas valve earlier or later during the suction stroke, but always closing at the end of this stroke, is a method of governing which is of recent years rapidly coming into use and is a most satisfactory method at any rate for large gas engines. By admitting the air and gas in this way when working on light loads air only is first drawn in, the gas being admitted towards the end of the suction-stroke; the result is that part of the charge next to the piston does not contain any gas or at any rate a very small proportion, but the part near the ignition point has sufficient to make it freely ignitable, there being what is known as stratification throughout the cylinder during both the suction and the compression strokes. In the earlier days of gas engines, Mr. Frank Crossley perfected a method of applying this principle to the smaller engines made in those days by means of a stepped gas cam for opening the gas valve, the various steps causing the gas valve to be opened earlier or later according to the power required but always closing with the air. A considerable number of engines were made in this way, but as it was found that ordinary hit-and-miss governing was practically as good, they were given up, the air-line governing of the hit-and-miss comparing very favorably with the increased movement of the governor necessary to move the roller operating the gas die from one step to another. The engines which were governed in this way were only of small powers and usually operated by rich illuminating gas.

A very considerable proportion of the large gas engines recently made have been governed in this manner, including all of the Oechelhäuser and Koerting types, in which it is practically necessarily adopted. Also a very large number of double-cylinder engines which unavoidably have considerable inertia in the reciprocating parts. In its application to these latter engines such arrangements have recently been described and illustrated.

The author's firm having recently constructed some tandem engines of 500 to 600 HP., the question as to the method of governing them had to be considered. It was decided that on the first engine a governor-valve operated by a trip-gear, similar to some of the gears above referred to, should be applied to one cylinder and a novel type of governor applied to the other, the intention being to adopt permanently the kind which proved to be most satisfactory in working; the result was that the trip governing gear was abandoned and the other adopted, it proving to be more simple, more prompt in action, considerably cheaper and thoroughly reliable. The arrangement of the gear is shown in Fig. 3; it is also illustrated in Figs. 4 and 5 taken from photographs of one of these engines. Referring to Fig. 3, a main casting is fixed on the top of the cylinder in which the valve proper is inserted. It has an air connection containing a throttle valve which is fixed definitely in one position to suit the gas which is being used, also a gas connection containing a gas cock, which serves to regulate the gas. The admission valve is opened at the commencement of each suction stroke by means of a cam rod and lever in the usual manner, being closed by a spring at the end of the suction strokes. The gas valve is centered on the spindle of the admission valve and has attached to it at its upper end a vacuum piston; the admission of air, either freely, partially or its non-admission to the vacuum cylinder, is controlled by a cylindrical plug, having a groove turned in it which opens or closes the air connection. The position of this plug is decided by the governor, a movement of about half an inch controlling the speed of the engine from full load to no load. Acting on the gas valve there is a spring which forces the vacuum piston to the end of its upward stroke whenever the admission valve is closed, being assisted finally by a strong buffer spring. When the admission valve is closed, it will be seen that the spring is neutralized; as soon as the admission valve commences to open, the pressure of this spring at its upper end is taken by the nut which is screwed on the spindle of the admission valve, and the pressure at the lower end tends to open the gas valve. If the plug allows free access of air to the vacuum cylinder, the gas valve moves with the admission valve and also closes with it, allowing a uniformly rich charge to be drawn into the cylinder during the whole of the suction stroke, thus giving full power impulses. If, however, the plug closes the communication from the atmosphere to the vacuum cylinder, the vacuum in the cylinder prevents the gas valve being opened, a few pounds vacuum in this cylinder being amply sufficient to overcome the power exerted by the spring; under these circumstances no gas is admitted during the suction stroke, but as the air passage is freely open, air only is drawn into the cylinder and there is no impulse; this represents two extremes, which in practice rarely occur, as the plug is usually in such a position as to give a more or less restricted admission of air, causing a partial vacuum in the vacuum cylinder at the commencement of each suction stroke, this partial vacuum, restraining the opening of the gas valve, making it open later and more slowly; it, however, catches up to the main admission valve and always closes with it, consequently air only to a greater or less extent is drawn in first and a rich mixture at the last. There is a small shifting valve opening outwards from the vacuum cylinder which always ensures the prompt return of the valve in closing. There is also an indicator (see special section) which rests on the vacuum piston, moves with it and gives an external indication of the action of the gas valve.

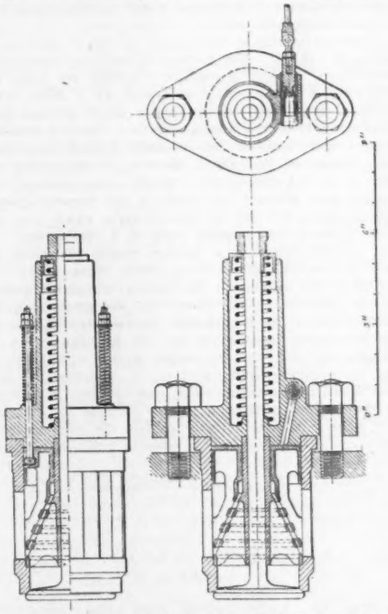


Fig. 10. Pneumatically Controlled Cut-off Valve for Small Gas Engines.
Crossley Bros., Ltd., Manchester, Eng.

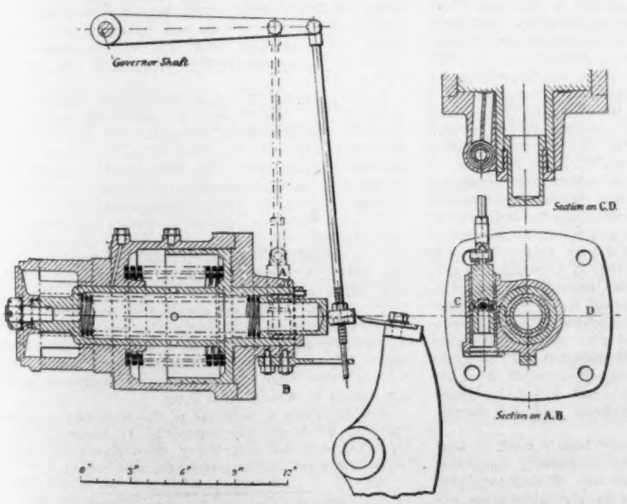


FIG. 9. AUTOMATIC GAS REGULATING VALVE.

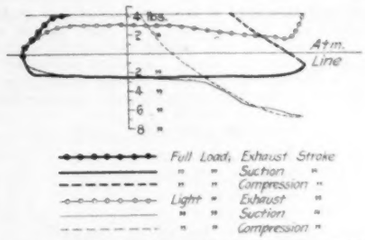


Fig. 11. Light Spring Indicator-Diagrams, Taken From Gas Engines Working with Full and Light Loads.

It will be seen that all the governor has to do, when governing a tandem engine having two single-acting cylinders, is to move two small cylindrical plugs which are an easy sliding fit in their cylinders, the plugs themselves being always in equilibrium, with the result that prompt and certain control is always ensured. The vacuum pistons, the springs, and the other moving parts are all enclosed and shut off from communication with the gas, consequently any tar or dust in the gas can only gain access to the gas valve which is so constructed that they cannot clog its movement; the mechanical parts are also constructed so that any wear will be infinitesimal. The actual operating medium is atmospheric air which is costless and indestructible.

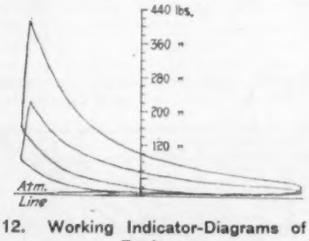


Fig. 12. Working Indicator-Diagrams of Gas Engines.

A short time ago an engine fitted with these valves was tested by Dr. Nicolson, Professor of Engineering at the Municipal School of Technology, Manchester. An extract of his report is as follows:

"Variation of speed, full to light load."—The engine speed varied only from 119.4 to 121.4 revolutions per minute when the horse-power was instantaneously dropped from about 600 to about 50. The total variation in speed was therefore 1⅝% of the mean speed. The full load was then thrown on again as quickly as possible, and so on in succession. The speed of the engine under such circumstances never varied more than the above percentage. This system of governing must therefore be admitted to be a very good and close one. No back firing of any kind took place. The engine supply valves, which had been adjusted at the commencement of the trial, were not touched or altered in any way while the trials were being made.

A further advantage of this gear is that it is perfectly noiseless, with the exception of a slight hissing noise due to air entering and leaving the vacuum cylinders. This noise could, of course, be easily prevented, but as it is an audible indication of the working of the valves and of the load on the engines, it is of consid-

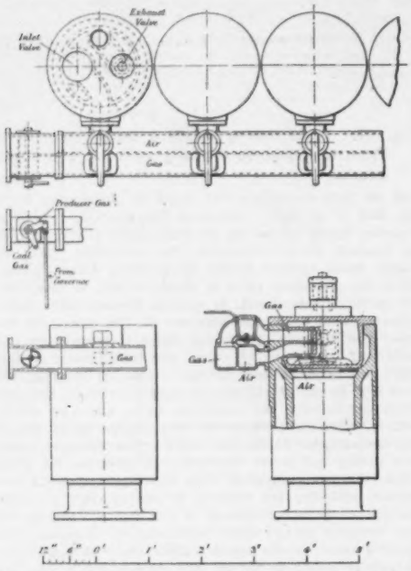


Fig. 13. Device for Separating Gas and Air, Until Entering Cylinder.

As arranged for vertical high-speed gas engines by Crossley Bros., Ltd., Manchester, Eng.

erable service in supplementing the visible indicators above referred to.

It will be seen from the above extract from Dr. Nicolson's report that the maximum variation in speed from full load to practically no load, was only 1⅝%, being obtained with a movement of the governor plugs of about one-half an inch; it is quite possible to reduce this half-inch to say one-eighth of an inch by causing the plugs to open and close cylindrical narrow ports, instead of round holes; in this manner the speed variations might be reduced to almost nothing. In most cases, however, a speed variation of 1½ to 2% is preferable. Diagrams taken from engines fitted with this gear are given in Figs. 6, 7 and 8.

It is of course an essential point in connection with governing gear that the economy of the engine should not be interfered with, and it is satisfactory to note that in the tests above referred to a remarkably low consumption was obtained. The gas was made from bituminous coal in a Crossley plant. A sample was analyzed by Dr. Nicolson, and gave:

Carbon dioxide	(CO_2)	11.4
Unsaturated hydrocarbons	(C_2H_4)	none
Oxygen	(O_2)	1.0
Carbon monoxide	(CO)	15.1
Hydrogen	(H_2)	24.3
Methane	(CH_4)	3.5
Nitrogen (difference)	(N_2)	44.7
		100.0

The calorific value on the lower scale works out to 156.5 B.T.U. per cubic foot, at 0° centigrade and 760

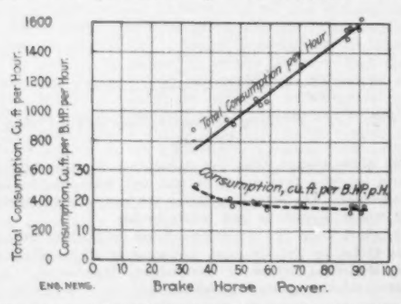

Total Consumption, Cu. ft. per Hour.
Consumption, Cu. ft. per B.HP. per Hour.
Total Consumption per Hour
Consumption, cu. ft. per B.HP. p.H.
ENG. NEWS.
Brake Horse Power.

Fig. 14. "Throttle" Governing a Single-Cylinder Gas Engine from 35 to 90 B. HP., Combined with "Hit-and-Miss" Method and Lighter Loads.

mm. pressure. The gas was also tested in a Junker calorimeter during the time of the test, the gas being taken from close to the inlet to the engine; the result was 149 B.T.U. per cubic foot on the lower scale, at atmospheric temperature and pressure, according very closely to the heat value given by the analysis. The engine was running on a brake load of 539 HP., the gas consumption per B.HP. reduced to 0° centigrade and 760 mm. was 51.94 cu. ft. per B.HP. per hour. The heat supplied was therefore 8,128 B.T.U. per brake horse-power per hour. The thermal efficiency on the brake was therefore 31.32%. So far as the author is aware this is the highest efficiency that has been obtained in a large gas engine in any well-authenticated trial.

The same method of governing has been successfully applied to smaller engines, in which the gas-valve has been arranged independently of the main admission valve and combined with hit-and-miss, this arrangement being more suitable for smaller engines. It is fully shown in Fig. 9, which explains itself.

Quantity governing as represented by suddenly cutting off the charge has been adopted in some instances, a very common method being to use cut-off gears, practically identical with similar gears as used with steam engines. These have been successful in practice, but unfortunately necessitating in most cases trip arrangements which require heavy and powerful governing gear, together with somewhat noisy operation and considerable wear and tear.

A method which is being used in some instances is shown in Fig. 10. The method of operation bears some resemblance to that previously described for large engines, being pneumatically controlled by a small cylindrical plug opening and closing a small passage communicating from the atmosphere to a vacuum cylinder; in this case, however, the vacuum is used to restrain the closing of the valve, instead of restraining the opening of the valve. The cut-off valve consists of a conical part directly connected to the vacuum piston, and having a number of annular ports which open and close corresponding annular ports in a conical seat. At the commencement of a suction stroke the ports are open as shown, the vacuum piston being always returned to this position by the external adjustable springs. If the governor plug closes the communication, the valve remains in the opened position throughout the suction stroke, because no air can be drawn into the vacuum cylinder, and the engine draws in full charges and gives full-powered impulses; if, however, the little plug opens the communication, more or less, the suction of the engines causing a suction on the cut-off valve and piston, drawing a little air into the vacuum cylinder and allowing the cut-off valve to move so as to cut

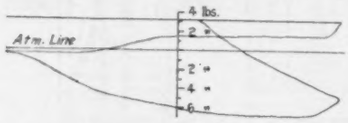


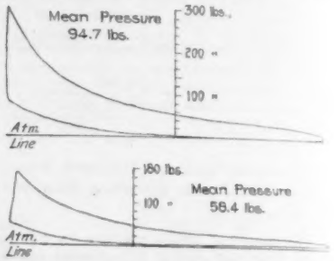
Fig. 15. Light Spring, Half Load Indicator-Diagram.
(See Test Fig. 14.)

off the charge earlier or later, according to the extent of the opening of the communicating passage.

Light spring diagrams, Fig. 11, show the action which takes place in the cylinder on full load and about half load; it will be seen that on light loads there is a considerable vacuum in the cylinder at the end of the stroke. As, however, no more air or gas can obtain access to the cylinder after the cut-off valve has closed, the piston on its return compression-stroke recompresses the charge to about atmospheric pressure on the same line as the suction line, then going on, compresses the charge up to a lower compression pressure than for a full-power stroke; although the smaller charges are ignited at a lower compression pressure, it will be seen from the working diagrams, Fig. 12, that the expansion of the smaller charges is carried out more nearly to atmospheric pressure, resulting in satisfactory economical working. In this case it is also desirable to combine hit-and-miss governing with the cut-off, and engines constructed in this manner are practically as economical as engines governed on hit-and-miss only. This will be seen by again referring to Fig. 2, in which the dot-and-dash lines show two of the engines working with cut-off governing, the tests being made on the same engines at the same time and working alternately with this method and with hit-and-miss only. Two four-cylinder engines of about 450 effective HP. recently constructed for driving alternators in parallel, were fitted with this type of governor, and had a maximum speed variation, under any change of load, not exceeding 1%.

Throttle governing has been very largely used, vertical high-speed engines being almost universally controlled in this manner, also large numbers of single-cylinder horizontal engines. As applied to vertical engines the usual method has been to throttle a uniform mixture into a pipe from which each cylinder draws its charge, the mixture in this pipe being nearly at atmospheric pressure for full loads and various pressures below the atmosphere for lighter loads. One objection to this arrangement is that if, from any irregular working in any of the cylinders, a back-fire takes place the contents of the pipe itself are fired, thus fouling the charges in the other cylinders and causing imperfect action in them also. As a remedy for this the author's firm has adopted the arrangement shown in Fig. 13, in which the gas and air are separately throttled into separate pipes communicating with the cylinders, the gas and air being kept separate until they pass through the admission valves into each cylinder, where also there is an independent gas-regulating cock. The gas cocks enable the cylinders to be regulated independently or even in emergency shut off.

The gas and air throttle valves are arranged on the same spindles, and they can be rapidly drawn out for



Figs. 16 and 17. Full and Half Load Working Indicator-Diagrams of Gas Engines, Combining "Throttle" with "Hit-and-Miss" Governing.

cleaning or inspection. The throttle valves themselves have four cutting-off edges, these four edges in the air throttle being similar, but in the gas throttle valves, two of them are similar to those of the air throttle to be used when the engine is running on producer gas; but the other two are arranged with inclined surfaces of such a shape that they give suitable proportions of gas areas, to the air areas, when working with rich illuminating gas. In some instances it is useful to be able to change over from one kind of gas to another without stopping the engine, and in the arrangement shown it is only necessary to disconnect the governor rod from one arm of the bell-crank lever which operates the throttle valves and connect it to the other arm, an operation which can be performed without stopping the engine.

Throttling governing is frequently applied to single-cylinder small and medium-sized engines, which represent such a large proportion of the gas engines made; a test of such an engine is shown in Fig. 14. In this case, however, the throttle governing was combined with hit-and-miss governing on the lighter loads. Under these circumstances the economy of the engine is quite satisfactory; a light spring diagram, Fig. 15, shows what takes place in the cylinder at about half load, and Figs. 16 and 17 are working diagrams on full load and about half load. This method of governing is very useful and satisfactory for engines working with their own suction-gas plant, by adjusting the connection to the hit-and-miss governing, and so arrange it that the throttling is carried down to very light loads. Under these circumstances the gas is somewhat uneconomically utilized on these lighter loads, but as it is desirable to keep the producer working, and making at least a moderate amount of gas under all conditions, there is a sufficient reason for working an engine and plant in this manner.

Throttle governing for single-cylinder horizontal engines is very largely used in continental practice, the methods usually adopted being to vary the lift of the admission valve, or to place a throttle valve in the passage to this valve. The first method is carried out in a very satisfactory manner by the Gas Motoren Fabrik, Deutz. In their arrangement the admission valve is operated in the usual manner by means of a cam rod and rocking lever, the fulcrum of which however is shifted by the governor so as to vary the lift of the valve. A somewhat powerful governor is necessary. One objection to all kinds of quantity governing is that very powerful springs are required on the admission and exhaust valves, as very commonly the partial vacuum in the cylinder is as low as 9 lbs. below the atmosphere. Gas-engine valves invariably open inwards, and a large valve requires a strong spring to prevent its being opened by a suction of 9 lbs.

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The floods in the South during the last week again call attention to the need of well-considered measures to prevent, or at least to lessen, such disasters. What such measures should be we will not attempt to say at this time, but the frequent occurrence of such disasters in the South during the past few years ought to set the people of that section to thinking and planning for either preventive or ameliorative works. With every year of neglect there is reason to believe that conditions are growing worse. Here, certainly, is work for both State and interstate commissions devoted to the conservatism of natural resources.

If typhoid-infected water can be rendered sterile by a few weeks' storage, as is proved anew by the interesting London experiments reported elsewhere in this issue, why not build huge reservoirs instead of immense filtration plants to make safe the water supplies of our large cities? The answer is obvious: The heavy capital charges for land and for construction would far exceed the combined capital and operating charges for filtration. This is particularly true of supplies drawn from streams near large cities, because in such localities land is high-priced and the topography generally makes the unit cost of providing storage capacity high also. But while this is true as regards sufficient storage to insure sterility, it is frequently quite feasible, as well as highly advantageous, to provide a moderate amount of storage for the sake of the bacterial reduction and other improvements in the water that may be effected thereby.

Doubtless it will strike many who read our abstract of Dr. Houston's London report, mentioned above, that he is inclined to lay too much stress on the desirability of delivering a typhoid-sterile water to the filters. But it will be noted that he recognizes that there is an economic and also a hygienic limit beyond which it will not pay to go, and that he considers storage so advantageous that he is willing to increase the rate of filtration in order to secure the benefit of storage.

Dr. Houston's tentative suggestion for four weeks' storage, it should be remembered, is far more feasible for the low water consumption of London than it would be for New York, with three times the per capita consumption; or Philadelphia, with five or six times; or some of our still more wasteful cities, which report consumption and waste up to 250 or 300 gal. per head per day.

Finally, it should be remembered that Dr. Houston's studies are not yet completed, so that his conclusions thus far given are subject to modification. They are certainly interesting, suggestive and worthy of thoughtful consideration on both sides of the Atlantic.

When a commuter boards a morning train for his trip from a suburb to the city, his first object is to get to his office or store as quickly as possible and his second to continue to enjoy his newspaper or whist until he arrives at his destination. But only a small percentage of commuters are able to ride to their office doors without a change in their mode of conveyance and a longer or shorter walk. The walk, obviously, cannot be wholly eliminated, but in the ideal system of urban and suburban transportation of the future—and let us hope the near future—the change from steam to electric railway or ferryboat will be unnecessary.

Perhaps New York, with its chief business interests packed into the lower end of a relatively long and narrow island, has been the worst example of inconvenient transportation between the suburbs and the city. We say "has been" because many improvements have already been made and others are nearing completion which eliminate ferryboats and bring passengers near their places of business by rail, even though a change from steam to electric cars is still necessary for most commuters.

A further and notable change for the better has just been suggested as a possibility. This is nothing less than a subway extension of the New York, New Haven & Hartford R. R. as far as the Battery, by which its commuters would be enabled to sit in their seats until stations near their down-town destinations were reached. The details or the chances of realization of this proposition need not be presented here, since we are concerned with a general defect in commuter transportation and mention the above possibility only as an illustration of how the defect may be, and as we believe often should be, remedied.

The electrification of, first, street railways and, second, the terminal and suburban portion of steam railways (the latter only well begun as yet) makes possible such a unification of urban and suburban passenger conveyance as will actually land a large percentage of commuters within easy walking distance of their daily work.

The Pennsylvania R. R. has been far-seeing enough to tunnel beneath Manhattan and the two rivers on either side, so as to bring commuters and through traffic alike onto Manhattan Island without change of train. By other agencies, more or less closely allied, tunnels to serve the street railway traffic of northeastern New Jersey, as well as the various steam railway lines now terminating on the west side of the Hudson, have been or are being built. These river tunnels, it is true, involve a break in the car journey of the commuter, but some day that may be done away with on all, as it already promises to be on some, of the lines.

Decades ago, the New York & Harlem R. R., long since under control of the New York Central, brought its passengers down to the city hall. With two rebuildings of the Central terminal within a dozen years, and with the subway construction before its eyes, why has not the Central wakened to the need of landing its commuting passengers downtown instead of leaving the chance for the New Haven road to seize? But any such accommodation to the public has been so far from its thoughts that when the first subway was built by the city, the railway did nothing to secure direct covered passage between the Grand Central Station and the subway, which passes its door. Consequently, thousands of persons, every day in the year, regardless of storm or heat, must make their way between the subway and the Grand Central Station by way of the open street.

We can conceive of no more striking example of lack of coordination in city transportation service. Of course the blame rests partly upon the old Rapid Transit Commission.

Whatever may be the outcome of the proposed New Haven subway connection its mere suggestion as a possibility, and that by the president of the road, gives reason to hope for better days. But if the public should be served as it has a right to demand it must look out for its own interests. Heretofore it has accepted such facilities as the railways have offered. Hereafter it must take a hand in seeing that its needs are met.

SOME FEATURES OF THE DESIGN OF STEEL PASSENGER CARS.

Now that financial conditions promise to improve, a steady increase may be expected in the use of steel cars for passenger train equipment, commenced a few years ago. While the use of steel passenger cars has been mainly on rapid-transit lines and for suburban service on main lines, several railways (and notably the Pennsylvania R. R.) are introducing steel cars for their main-line traffic. The special reason for the use of steel construction in passenger train equipment is the increased safety which it affords, owing to the greater strength and fireproof qualities of the cars, as compared with wooden cars. There may also be found an actual economy to the railways, due to the greater strength resulting in greater durability and lower cost for maintenance and repairs. The decreasing supply and increasing cost of large timbers for car construction must also be taken into account.

In this article we propose to discuss some of the principal features of the design and construction of steel passenger cars. In another column we describe a number of steel cars of different kinds for passenger-train equipment on various railways. These not only illustrate the extent of the present development, but also represent different types of structural design. Some of the cars have been built by the railways, and others by car-building companies.

In the structural design of steel cars, a fundamental point for consideration is that of the stresses to which the framing will be subjected in service. The most severe service stresses (omitting collisions) are those due to buffing shocks in switching, but there is little reliable knowledge as to what the stresses actually are or the manner of their distribution. Tests made with steel freight cars on the Pennsylvania R. R. in 1907, and on the Lake Shore & Michigan Southern Ry. in 1902, indicated buffing stresses of 400,000 lbs. to 600,000 lbs. The report of a committee on steel passenger cars, presented at the annual convention of the Master Car Builders' Association in 1908, contained the following statement on this point:

> In collisions between passenger and freight cars, the passenger cars should not be seriously damaged. This requires the passenger car center-sill construction to be at least as strong as that of the strongest freight cars. For passenger cars it is advisable to use a higher factor of safety. Therefore, the center-sill construction in passenger equipment cars used in through trains should be capable of withstanding a shock of 150,000 lbs. on the draft year and 250,000 lbs. on the buffers. This makes a total of 400,000 lbs. compression, in which the combined stresses should be 12,500 lbs. per sq. in., and in no case exceed 15,000 lbs. per sq. in. For cars used strictly in suburban service (in comparatively short trains with coaches of the same size) the fiber stress might be increased to 20,000 lbs., but this figure should not be exceeded.

In the Union Pacific Ry. car having side frames forming trusses 7 ft. deep the fiber stress in any member does not exceed 12,000 lbs. per sq. in. In the design of the Pennsylvania R. R. cars, the compression load due to buffing shocks is assumed at 400,000 lbs., distributed as 250,000 lbs. between the buffers and 150,000 lbs. in the draft rigging. This is, of course, to be added to the load due to the weight of the car. The weight due to passengers is relatively so small as to be negligible. The combined fiber stress under these conditions is limited to 12,500 lbs. and 20,000 lbs. per sq. in. for the main line and

A further advantage of this gear is that it is perfectly noiseless, with the exception of a slight hissing noise due to air entering and leaving the vacuum cylinders. This noise could, of course, be easily prevented, but as it is an audible indication of the working of the valves and of the load on the engines, it is of consid-

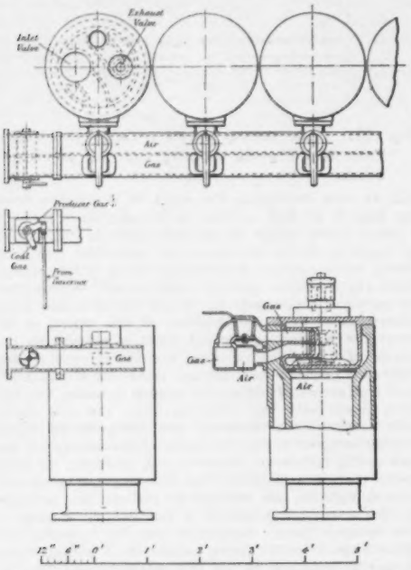


Fig. 13. Device for Separating Gas and Air, Until Entering Cylinder.

As arranged for vertical high-speed gas engines by Crossley Bros., Ltd., Manchester, Eng.

erable service in supplementing the visible indicators above referred to.

It will be seen from the above extract from Dr. Nicolson's report that the maximum variation in speed from full load to practically no load, was only 1⅝%, being obtained with a movement of the governor plugs of about one-half an inch; it is quite possible to reduce this half-inch to say one-eighth of an inch by causing the plugs to open and close cylindrical narrow ports, instead of round holes; in this manner the speed variations might be reduced to almost nothing. In most cases, however, a speed variation of 1½ to 2% is preferable. Diagrams taken from engines fitted with this gear are given in Figs. 6, 7 and 8.

It is of course an essential point in connection with governing gear that the economy of the engine should not be interfered with, and it is satisfactory to note that in the tests above referred to a remarkably low consumption was obtained. The gas was made from bituminous coal in a Crossley plant. A sample was analyzed by Dr. Nicolson, and gave:

Carbon dioxide	(CO_2)	11.4
Unsaturated hydrocarbons	(C_2H_4)	none
Oxygen	(O_2)	1.0
Carbon monoxide	(CO)	15.1
Hydrogen	(H_2)	24.3
Methane	(CH_4)	3.5
Nitrogen (difference)	(N_2)	44.7
		100.0

The calorific value on the lower scale works out to 136.5 B.T.U. per cubic foot, at 0° centigrade and 760

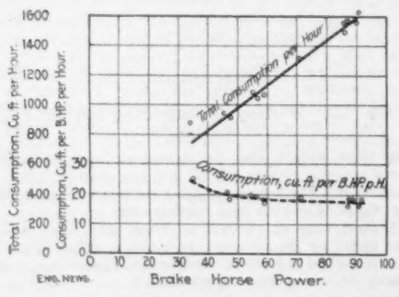

Total Consumption, Cu. ft. per Hour.
Consumption, Cu. ft. per B.HP. per Hour.
Total Consumption per Hour
Consumption, cu. ft. per B.HP. p.H.
ENG. NEWS.
Brake Horse Power.

Fig. 14. "Throttle" Governing a Single-Cylinder Gas Engine from 35 to 90 B. HP., Combined with "Hit-and-Miss" Method and Lighter Loads.

mm. pressure. The gas was also tested in a Junker calorimeter during the time of the test, the gas being taken from close to the inlet to the engine; the result was 149 B.T.U. per cubic foot on the lower scale, at atmospheric temperature and pressure, according very closely to the heat value given by the analysis. The engine was running on a brake load of 550 HP., the gas consumption per B.HP. reduced to 0° centigrade and 760 mm. was 51.94 cu. ft. per B.HP. per hour. The heat supplied was therefore 8,128 B.T.U. per brake horse-power per hour. The thermal efficiency on the brake was therefore 31.32%. So far as the author is aware this is the highest efficiency that has been obtained in a large gas engine in any well-authenticated trial.

The same method of governing has been successfully applied to smaller engines, in which the gas-valve has been arranged independently of the main admission valve and combined with hit-and-miss, this arrangement being more suitable for smaller engines. It is fully shown in Fig. 9, which explains itself.

Quantity governing as represented by suddenly cutting off the charge has been adopted in some instances, a very common method being to use cut-off gears, practically identical with similar gears as used with steam engines. These have been successful in practice, but unfortunately necessitating in most cases trip arrangements which require heavy and powerful governing gear, together with somewhat noisy operation and considerable wear and tear.

A method which is being used in some instances is shown in Fig. 10. The method
resemblance to that previously
gines, being pneumatically contr
drical plug opening and closing
municating from the atmosphere
in this case, however, the vacu
the closing of the valve, inst
opening of the valve. The cut-
conical part directly connected
and having a number of annula
close corresponding annular port
the commencement of a suctio
open as shown, the vacuum p
turned to this position by the ext
If the governor plug closes t
valve remains in the opened
suction stroke, because no air
vacuum cylinder, and the engine
and gives full-powered impulses;
plug opens the communication, m
of the engines causing a suctio
and piston, drawing a little air
der and allowing the cut-off valv

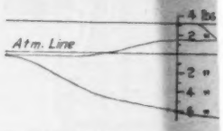


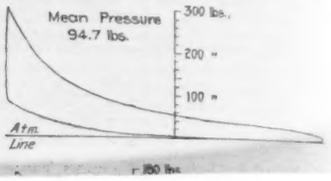
Fig. 15. Light Spring, H
Diagram.
(See Test Fig.

off the charge earlier or later,
of the opening of the communic

Light spring diagrams, Fig. 11,
takes place in the cylinder on fu
load; it will be seen that on ligh
siderable vacuum in the cylinder at the end of the stroke. As, however, no more air or gas can obtain access to the cylinder after the cut-off valve has closed, the piston on its return compression-stroke recompresses the charge to about atmospheric pressure on the same line as the suction line, then going on, compresses the charge up to a lower compression pressure than for a full-power stroke; although the smaller charges are ignited at a lower compression pressure, it will be seen from the working diagrams, Fig. 12, that the expansion of the smaller charges is carried out more nearly to atmospheric pressure, resulting in satisfactory economical working. In this case it is also desirable to combine hit-and-miss governing with the cut-off, and engines constructed in this manner are practically as economical as engines governed on hit-and-miss only. This will be seen by again referring to Fig. 2, in which the dot-and-dash lines show two of the engines working with cut-off governing, the tests being made on the same engines at the same time and working alternately with this method and with hit-and-miss only. Two four-cylinder engines of about 450 effective HP. recently constructed for driving alternators in parallel, were fitted with this type of governor, and had a maximum speed variation, under any change of load, not exceeding 1%.

Throttle governing has been very largely used, vertical high-speed engines being almost universally controlled in this manner, also large numbers of single-cylinder horizontal engines. As applied to vertical engines the usual method has been to throttle a uniform mixture into a pipe from which each cylinder draws its charge, the mixture in this pipe being nearly at atmospheric pressure for full loads and various pressures below the atmosphere for lighter loads. One objection to this arrangement is that if, from any irregular working in any of the cylinders, a back-fire takes place the con
of the pipe itself are fired, thus fouling the charges
other cylinders and causing imperfect action
also. As a remedy for this the author's firm has
the arrangement shown in Fig. 13, in which the
air are separately throttled into separate pipes
municating with the cylinders, the gas and air
kept separate until they pass through the ad
valves into each cylinder, where also there is an
pendent gas-regulating cock. The gas cocks enab
cylinders to be regulated independently or e
emergency shut off.

The gas and air throttle valves are arranged
same spindles, and they can be rapidly drawn



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Now that financial conditions promise to improve, a steady increase may be expected in the use of steel cars for passenger train equipment, commenced a few years ago. While the use of steel passenger cars has been mainly on rapid-transit lines and for suburban service on main lines, several railways (and notably the Pennsylvania R. R.) are introducing steel cars for their main-line traffic. The special reason for the use of steel construction in passenger train equipment is the increased safety which it affords, owing to the greater strength and fireproof qualities of the cars, as compared with wooden cars. There may also be found an actual economy to the railways, due to the greater strength resulting in greater durability and lower cost for maintenance and repairs. The decreasing supply and increasing cost of large timbers for car construction must also be taken into account.

In this article we propose to discuss some of the principal features of the design and construction of steel passenger cars. In another column we describe a number of steel cars of different kinds for passenger-train equipment on various railways. These not only illustrate the extent of the present development, but also represent different types of structural design. Some of the cars have been built by the railways, and others by car-building companies.

In the structural design of steel cars, a fundamental point for consideration is that of the stresses to which the framing will be subjected in service. The most severe service stresses (omitting collisions) are those due to buffing shocks in switching, but there is little reliable knowledge as to what the stresses actually are or the manner of their distribution. Tests made with steel freight cars on the Pennsylvania R. R. in 1907, and on the Lake Shore & Michigan Southern Ry. in 1902, indicated buffing stresses of 400,000 lbs. to 600,000 lbs. The report of a committee on steel passenger cars, presented at the annual convention of the Master Car Builders' Association in 1908, contained the following statement on this point:

> In collisions between passenger and freight cars, the passenger cars should not be seriously damaged. This requires the passenger car center-sill construction to be at least as strong as that of the strongest freight cars. For passenger cars it is advisable to use a higher factor of safety. Therefore, the center-sill construction in passenger equipment cars used in through trains should be capable of withstanding a shock of 150,000 lbs. on the draft year and 250,000 lbs. on the buffers. This makes a total of 400,000 lbs. compression, in which the combined stresses should be 12,500 lbs. per sq. in., and in no case exceed 15,000 lbs. per sq. in. For cars used strictly in suburban service (in comparatively short trains with coaches of the same size) the fiber stress might be increased to 20,000 lbs., but this figure should not be exceeded.

In the Union Pacific Ry. car having side frames forming trusses 7 ft. deep the fiber stress in any member does not exceed 12,000 lbs. per sq. in. In the design of the Pennsylvania R. R. cars, the compression load due to buffing shocks is assumed at 400,000 lbs., distributed as 250,000 lbs. between the buffers and 150,000 lbs. in the draft rigging. This is, of course, to be added to the load due to the weight of the car. The weight due to passengers is relatively so small as to be negligible. The combined fiber stress under these conditions is limited to 12,500 lbs. and 20,000 lbs. per sq. in. for the main line and

suburban cars, respectively. These cars have a very heavy center-sill construction, forming a box girder. In the calculations for strength, the web plates of the sides of the body (with their top chord angles) and all material above the belt rail, are left out of consideration. It was held that owing to their great length and width the plate girders of the sides would probably collapse under direct end thrust. The accompanying table was prepared by the Pennsylvania R. R. in regard to its new steel cars:

STRESSES IN STEEL AND WOODEN PASSENGER CARS: PENNSYLVANIA R. R.

	Wooden coach.	Steel coach.	Steel suburban.
Length	53 ft.	70 ft.	54 ft.
No. of passengers	62	88	72
Weight of car, lbs.	91,000	*113,500	†75,000
Weight of car per pass., lbs.	1,470	1,290	1,042
Area of center sill at middle of car, sq. ins.	152	50	24.32
Area of center sill at center plate, sq. ins.	152	50	33.32
Stress in center sills due to 150,000 lbs. compression on draft gear and 250,000 lbs. on buffer, lbs. per sq. in.	10,850	11,000	18,500
Comparative values of center sills	25%	100%	60%

*Estimated weight (including 6,000 lbs. for storage battery).
†Estimated weight.

It is rather remarkable that the Master Car Builders' Association has given very little attention to the development of steel passenger car construction. This is doubtless because it has failed to recognize the future possibilities and probabilities in this direction, but of late years its energies appear to have been devoted to matters of detail rather than to broader questions of car design. With cars of this type in actual use, however, the problems of their design, maintenance, repair and equipment will be forced upon the attention of the car department officers. At the 1904 convention of the Association, a paper on steel construction for passenger cars was presented by Mr. Wm. Forsyth, who referred to the steady increase in weight of cars and suggested the use of steel as a means of increasing safety in transportation without any further increase in weight.

The subject was not again considered by the Association until the 1908 convention, when a committee presented a somewhat extended report. This, unfortunately, was not discussed. It was recommended, however, that the subject of standard structural shapes for steel freight and passenger cars should be reported upon at the next convention. The recommendation was not adopted, and steel passenger-car construction will not be considered at the convention of 1909.

In the design of steel passenger cars, there are different systems of framing to be considered. All of these, of course, are intended to carry the load due to the weight of the car and its contents, and to transmit this to the trucks by means of the center bearings. In the first place, there is the central-girder system. Here the center sills are made heavy enough to carry the entire load, the sides and superstructure being supported by cantilever cross-bearers riveted to the center sills. These sills transmit the dead-weight load directly to the trucks, and they also sustain the pulling and buffing shocks. This system is adopted in the cars of the Pennsylvania R. R., the center sills in this design being connected by cover plates so as to form a heavy box girder.

In the second place, there is the side-girder (or side-truss) system. Here the sides below the level of the windows form plate girders, which carry the entire load and transmit it through the body bolsters and center plates to the trucks. The center sills have to sustain only the pulling and buffing shocks. This system is represented in the cars of the New York Central Ry., and of several rapid-transit lines. In a modification of this system, the side framing of the body forms trusses which carry the load. This is the system employed in the Union Pacific Ry. car of the middle-entrance type, described elsewhere in this issue.

In the third place, there is the underframe system. This is similar to the usual system employed in wooden car construction. Center and side sills, with intermediate sills, cross-bearers, bolsters and connections form a frame or floor system upon which the load is distributed, and by which the load is transmitted to the trucks. This is the system employed in the baggage and mail cars of the St. Louis & San Francisco Ry., and in the cars of some rapid-transit lines.

In a combination of the first two systems, the side girders transmit a portion of the load to the center sills by means of cross-bearers between the bolsters. In this case, the center sills carry a proportion of the dead load, in addition to sustaining the buffing shocks. It has been suggested that center sills might be dispensed with, and all buffing and pulling stresses transmitted through the bolsters and side girders. We are not aware that this has ever been tried. In fact it does not appear advisable, as it would tend to cause severe shocks and vibration, with racking stresses on all connections.

In many designs, additional strength is given to the underframing by diagonal bracing (sometimes in the corner panels and sometimes in the main panels), or by a continuous deck of steel plate. In some designs, also, the sills are reinforced by truss rods, as in wooden cars, but it appears much better and simpler to dispense with these by making the sills strong enough and stiff enough in themselves.

In cars having side doors, such as mail and baggage cars and some suburban cars, the sides cannot be utilized as plate girders. For such cars a truss frame may be used for each side of the body, the door and window openings occupying the panel spaces. This is not always practicable where the openings are large and numerous, as is the case in many suburban and rapid-transit cars. Cars of this class have been built, however, with trusses 7 ft. deep, but in others the third or underframe system is used to carry the load.

It is not a difficult matter to design an underframe of ample strength, especially with the reinforcement afforded by steel deck plates and flooring. There is greater difficulty with the superstructure. The roof and body framing may be made with substantial posts or verticals connected by longitudinal members forming the belt rails, window sills, side-plates, and deck sills. As a rule there is little opportunity to use diagonal bracing, but the side sheathing may be utilized as web plating. In some of the latest cars, however, diagonals are fitted in the panels below the window sills, and knee braces between the posts and top side-plates. These braces are concealed by the side sheathing, which is shaped to form curved openings for the upper part of the windows and side doors. In this case the underframe and superstructure framing are built up complete, independent of the side plating. The latter is secured by rivets which do not form any part of the structural connections.

To ensure ample strength to resist shock and to prevent telescoping in case of collision, the posts must be strongly secured to the underframe and roof framing, while the end framing is made very heavy and well braced. With such construction, if the floor of one car should rise above that of the next one in the shock of a collision, it would be practically impossible for it to shear its way through the upper works of the latter, as is so often done with disastrous effects in accidents with wooden cars. Heavy stops rising above the car platforms have been used in some steel cars to relieve the superstructure framing in such an event. The steel vestibule, the body end framing and the hood of the roof should be heavily built, connected and reinforced to act as a collision bulkhead. The Pennsylvania R. R. cars are said to have a superstructure framing of sufficient strength to prevent collapse in the case of a car being overturned and rolled down an embankment.

In this connection, reference may be made to the elliptical or turtle-back roof adopted in some steel cars. This is discussed in the Master Car Builders' report mentioned above, and it appears that there are decidedly conflicting opinions as to whether this form of roof is stronger than, or has any advantages over, the ordinary monitor or upper-deck design. The latter provides additional light in the middle of the car, and while skylights might be provided in the elliptical roof, we believe they have not been used in any of the passenger cars now in service. If the elliptical roof is approximately at the level of the lower deck of the ordinary car, there is a material loss in head room. This, it is argued, would detract from the appearance of the car. If raised to the level of the upper-deck, it is said that there might be trouble with the clearance limits of some tunnels. The cost of the elliptical roof is probably less, owing to its simplicity. At any rate, the elliptical roof is as yet an experimental innovation, and there appears little doubt that a monitor roof of simple strength can be designed.

Both rolled and pressed steel shapes are used for structural members, and in some designs of cars these are used in combination. In many cases, all exterior rivets are concealed, the heads being countersunk or covered with moldings, but in some cars the ordinary rivet heads are left exposed. Special attention must be given to the design of the connections, in view of the shocks to be sustained in service, the continual vibration, and the racking stresses in both longitudinal and transverse directions, due to irregularities in track and the passage of curves. Ample area and an ample number of rivets must be employed, and the use of gussets and connection plates is very desirable to ensure sufficient rivets and strength at joints. The stresses will, of course, be very much more severe in a passenger car 70 or 80 ft. long, and 14 ft. high, supported on truck centers 50 or 55 ft. apart, than they will be in a 35-ft. or 40-ft. hopper or gondola freight car having truck centers spaced only 25 to 30 ft. apart.

The exterior roof is usually of light steel plate. In some cars, however, the steel is used only at the ends, to connect the end framing into a structure that will withstand heavy buffing shocks or even collisions. In such cases, the main part of the roof is of fiber board, attached to the steel carlines and framing. This is covered with canvas, which is well painted.

The floor system should be of sufficient strength to resist blows from broken brake-rods or brakebeams, etc. This is obtained in several designs by the use of steel deck-plating or a course of steel plate (flat or corrugated) to carry a cement floor. The floor itself must be strong enough to resist service stresses without cracking or fracture. It should be fireproof, non-absorbent, and sound insulating. This last may be obtained by a course of felt or similar material in the floor, or by placing a light false floor beneath the underframing, and packing loose sound-insulating material between this and the floor. A floor of cement composition is used very frequently, and may be covered with linoleum (or similar material) in the more elaborate cars. For suburban cars, however, a wearing surface of wooden slats may be used, being put together in sections or screwed to the floor.

The interior sheathing, headlining and partitions are of sheet steel or fiber board. The latter effects a reduction in weight, while retaining the fireproof and sanitary qualities. The board is made of various compositions of cement, asbestos, wood-pulp, etc., compressed under heavy pressure and subjected to different styles of treatment. Material of this class affords a wide selection for interior finish and decoration, and is a better non-conductor of heat and sound than is the steel lining.

An obvious possible objection to the steel sheathing is in regard to the temperature effect upon the interior of the car. In most cases, the outer sheathing is faced on the inside with asbestos cloth. Where steel is used also for the inner sheathing, it may be faced on both sides with this asbestos, and perhaps lined with fiber board on the interior of the car. The insulation combined with the air space between the inner and outer sheathings, and in conjunction with the ventilating and heating systems, is expected to obviate any trouble due to temperature or unpleasantness due to close contact with the steel lining. Thus, in the Pullman sleeping car, the steel interior lining is exposed throughout, being

merely painted. Experience will demonstrate whether any further measures must be taken to make steel cars comfortable under varying atmospheric or climatic conditions.

One advantage of the steel and fiber-board interior finish is that it tends to simplicity and the use of large plain surfaces, to the exclusion of the moldings and carved work used in wooden cars, and often used to an excessive extent. Simple moldings of copper, aluminum, brass or pressed steel may be employed where necessary, but no doubt the more elaborate work will be avoided as far as possible.

As to the exterior finish, time and experience alone will show what kind of paint will best meet the requirements of durability, economy, protecting the steel, and maintaining a good appearance. The latter requirement makes the problem much more difficult for steel passenger cars than for steel freight cars.

The fireproof qualities of steel cars are of special importance, particularly for cars in suburban and rapid-transit service, handling large crowds. In fact this has been one of the principal reasons leading to their adoption. The earlier cars had steel framing only, with wooden inner and outer sheathing, and sometimes wooden flooring. The majority of the more recent cars have cement floors, steel outer sheathing and roofing, and steel or fiber board for the inner sheathing or lining. Some of the cars have a considerable amount of wood furring, blocking and fillers, etc., for the attachment of the interior finish. This woodwork is generally protected, however, by being enclosed between the inner and outer steel sheathing. The first steel passenger car of the Pennsylvania R. R. contained some 1,500 lbs. of wood, while in the present adopted design this has been reduced to 300 lbs. (mainly for window sashes, seat arms and brake-rod guards). In the first car of the Southern Pacific Ry. there was no special attempt at fireproofing the interior, and the finish was of wood (mahogany) in the usual style. On the other hand, the steel mail cars of this and other roads have practically no wood either for construction or finish.

In some steel cars, special efforts have been made to exclude all inflammable material. Steel doors are used in some cars. Window sashes of metal have been used also, as in the steel sleeping car noted elsewhere, but as a rule it is considered preferable to make them of wood. In the same car, steel seat frames and fittings are used. The Master Car Builders' committee, however, appeared to think it unnecessary to carry this exclusion of wood to such an extreme. In case of accident, broken window glass might cause more injury than splintered wooden fittings. In fact, the use of wired-glass has been suggested for the steel cars of underground railways. In some cars for underground rapid-transit lines the seats are covered with a woven steel fabric instead of the usual rattan covering. The upholstering and carpets of ordinary cars may be treated chemically to render them inflammable. Fireproof paints may be used if considered advisable.

The greater safety of the steel car in case of railway accidents is one of the fundamental reasons for its introduction. The necessity of special provision for safety in cars for underground electric railways was the principal influence in determining the practical adoption of steel car construction for such lines. But for general railway service also, the steel car promises to greatly reduce the casualties in train wrecks. From the point of view of safety to passengers, steel construction is needed quite as much for the cars of ordinary trains as it is for those of high-speed long-distance trains. In fact it is in accidents to trains to the former class that a large proportion of the deaths and injuries occur. In trains of the latter class, the cars are as a rule equipped with vestibule connections, which form perhaps the best preventative of telescoping. In case of collision, it seems impossible to keep ordinary open-platform cars in line, so that the shock will be transmitted through the underframes. One car rises and its underframe is driven through the comparatively light body framing of the next car, which offers little resistance. The vestibule diaphragms prevent this, even in wooden cars, and would be still more effective in combination with a body steel framing which in itself would make a stronger structure.

The more substantial the body construction, the less disastrous is the result of the accident. This is evidenced by the comparative immunity from damage of this kind in sleeping cars, even in case of rear collisions. In head collisions, of course, these strong and heavy cars are, as a rule, protected by lighter day cars and baggage cars which are placed between them and the engine, and the crushing of which serves to absorb the force of the collision. Greater strength and stability in wooden cars can only be obtained by an increase in weight, but with the adoption of steel a great increase in strength becomes possible with practically no increase (and possibly a decrease) in weight.

In freight train accidents, steel cars suffer much less damage than wooden cars, and are often repaired at slight cost after treatment which would have put a wooden car beyond possibility of repair. In commenting upon the telescoping and crushing of passenger cars in railway accidents, in our issue of July 21, 1904, we made the following remarks:

> The behavior of steel cars in freight wrecks speaks strongly for the value of a rigid and resistant car body. These cars are thrown off the track, are piled upon each other, are battered and distorted, according to the violence of the accident. But they are not crushed to splinters as are passenger cars, nor are they telescoped. A box framed in steel, filled with passengers, would, even if thrown about and badly distorted, offer a much greater chance for life than does the wooden box of the present passenger car.

The maintenance cost of steel passenger cars cannot be determined until some years of experience with a considerable number of cars. We have, however, an extended experience with steel freight cars from which to draw some conclusions. In a review of the question of maintenance and repair of steel freight cars in our issue of June 23, 1904, it was shown that these expenses have been very much less for steel cars than for wooden cars. The maintenance is often nominal, being limited to occasional painting, but in passenger cars it would be higher on account of the necessity of keeping the car in good appearance. The repairs have been mainly due to injuries received in accidents. In our issue of Nov. 22, 1906, also, it was shown that the average cost of repairs for 11,700 steel freight cars and 10,600 wooden cars on the Harriman lines during a period of 17 months was $2.42 and $3.74 per car respectively.

The first cost of the steel passenger cars will necessarily be considerably higher than that of wooden cars, even if the latter are of heavy construction. The general use of steel cars, and the development of their manufacture as a commercial industry will tend to reduce the cost. But first cost is only one side of the question, and it is not at all improbable that steel cars will prove actually economical in the long run. Their life should be greater, and the cost of maintenance and repair less, while in case of accident a steel car may often sustain slight injury where a wooden car would have been crushed beyond repair. Furthermore, there is the insurance against damage suits to be considered. If a car load of freight is injured or destroyed, the damage is readily determined and the loss is not likely to be felt seriously by the company. But personal damages awarded against the company as the result of the wreck of a single passenger car may prove a very serious matter financially. Every injury and death in a train accident is liable to prove costly to the railway company. If a steel car will reduce this liability, this must be considered in comparing the relative cost and economy of steel and wooden passenger cars.

A still further financial argument in favor of the steel car is the effect of its introduction upon the public. Every improvement that is generally recognized as increasing the safety of railway travel tends to increase the passenger mileage and to make for that better feeling between the public and the railways that is so much to be desired. Finally, although it cannot be discussed here, the humanitarian side of the subject, as reflected in the reduction of physical and mental suffering and loss of limb and life, should not be overlooked.

LETTERS TO THE EDITOR.

A Statement from the Cameron Septic Tank Co.

Sir: A statement of the Association for the Defense of Septic Process Suits appeared in your issue of Aug. 13. After reciting in brief the opinion of the trial court, the reversal of that opinion as to process claims by a unanimous decision of the United States Circuit Court of Appeals, and the denial of a petition for rehearing, the Association proceeds to place its own construction on the process claims as sustained, and then concedes that the petition for writ of certiorari, which was stated as the primary object of the existence of that Association, had been denied by the Supreme Court of the United States and the decision of the United States Circuit Court of Appeals thereby upheld.

Having failed in the primary object of its organization, the Association invites additional contributions, and declares its determination: (1) to resist all attempts on the part of the Cameron Co. to have the case re-opened so far as the apparatus claims are concerned, unless the whole case is reviewed; (2) to resist all attempts on the part of the Cameron Co. to obtain an extension of its patent.

In a circular letter dated July 21, addressed by the Executive Committee to all the authorities believed to be interested, the Association declared its intention of formulating a plan of future procedure upon more prominent lines than hitherto drafted, and in addition to its declared intentions mentioned in its statement, outlined the following:

> Resistance to attempts, if made, on the part of the Cameron Co., to collect royalties for the past use of the so-called septic process in amounts exceeding the cost of cleaning out settling tanks with a frequency which would obviate an infringement of the said patent.
>
> An attempt to formulate a plan of united action by which, through litigation or otherwise, there can be arrived at a clearer understanding than now exists as to what tanks and what methods of operation constitute obvious infringement of the patent in question.
>
> In view of the uncertain attitude or position in which the whole subject of infringement is left apparently by the decision of the Circuit Court of Appeals, it seems necessary that this Association should secure data in connection with its other objects above outlined for arriving at a reasonable conclusion in the premises regarding the status of numerous tanks already in existence, and which conclusion shall be fair and logical both from a legal and engineering point of view.

Adding that:

> With an increasing membership and with increasing funds to assist in securing equity in this field of municipal sanitation, there will also be accumulated data to permit a well formulated plan of procedure to be outlined and submitted at a future date, and which program shall have for its purpose a minimum outlay by all members of the Association in dealing with this question.

Furthermore, an invitation is extended to infringing municipalities and individuals to avail themselves of the advice and counsel of the Association; adding that it is its intent and purpose to render all possible advice and assistance in the equitable adjustment of claims for past use of the Cameron process, and suggesting that all negotiations and correspondence with the Cameron Co. be carried on through the executive committee of the Association.

The Association for the Defense of Septic Process Suits consists mainly of a few engineers who, having freely recommended the adoption of the septic process, have as freely advised their clients to disregard the Cameron patent covering that process. With supreme indifference for the application of the law to such matters they long ago decided that the septic process was unpatentable; the United States Courts have decided otherwise.

Directly following a recent meeting of the Association in Columbus, O., a full column article appeared in a Columbus paper with scare-head-lines. This article outlines the result of the Cameron Septic Tank Co.'s suit against Saratoga Springs and states that the Association had placed in the hands of Senator O. E. Harrison, Special Counsel in the Office of the Attorney General, a list of thirty-five cities and towns in the State that have either installed septic tank plants or are proceeding under plans including the process. It is further stated that "the company making the claim has become very extravagant now in its demands since it has won a decision in the U. S. Court of Appeals"; and that it "is asking from Columbus $40,000."

As a matter of fact, no demands whatever have been made on the city of Columbus, nor is there any foundation for the statement that our demands have become extravagant since the decision of the U. S. Circuit Court of Appeals. For the accuracy of these statements we very confidently refer to the municipalities involved.

Since the decisions in our favor many settlements have been effected, and not one complaint has been made that our demands have been in any way unreasonable.

The very engineers who obtained their knowledge of the septic process from Cameron are the ones who, while utilizing that knowledge for infringements, have kept the Cameron Co. in litigation for the past five or six years, and are now seeking to force us into further unnecessary litigation by inciting their clients to resist our just and reasonable demands.

The Cameron Septic Tank Co. has offered to settle with infringing municipalities on liberal terms; many have accepted that offer, while others have been induced to support the Association for Defense of Septic Process Suits, hoping thereby to avoid payment of our claims.

The large majority of engineers, while sincere in their belief that the septic process was unpatentable, are now willing to accept the decisions of the United States Courts and are not in sympathy with the guerrilla warfare being waged on the Cameron Septic Tank Co. by the association. Their belief in the unpatentability of the septic process was probably due to their having confounded it with putrefaction, which they have very properly insisted is a natural process and has always existed. We are quite willing to admit that putrefaction is a natural process and always has and always will take place in any inert mass of organic matter. It exists in the remote recesses of cesspools, and in tanks used for the sedimentation of sewage solids unless removed at frequent intervals. It is this process of putrefaction that was so universally condemned by all the authorities on sewage disposal methods, prior to the introduction of the septic process, as dangerous to the public health, and we might add that unless intelligently combined with oxidation or nitrification it is equally dangerous to-day.

"Septic Action" is entirely distinct from the natural process of putrefaction; the latter is the act or process of putrefying, or the development of anaerobes within an inert mass of organic matter; septic action, on the other hands, is the action of the so-developed anaerobes on a slowly moving, or as expressed in the patent, a flowing current of sewage, and when combined with subsequent aeration and filtration, constitutes what is known as the septic process. As pointed out in the decision of the U. S. Circuit Court of Appeals, it consists in "the use of one of the agencies of nature for a practical purpose."

By an ingenious arrangement Mr. Cameron succeeds in utilizing the otherwise dangerous and universally condemned process of putrefaction by intelligent combination with subsequent oxidation, and what in nature was a menace to the public health, has become an important part of a process for the disposal of sewage that has completely revolutionized the art.

The process as sustained by the courts is described in the specifications of the patent as follows:

The invention consists in certain methods of developing in a flowing current of sewage bacteria capable of dissolving the mass of solid organic matter contained therein, of subsequently utilizing the so-developed bacteria in liquefying the mass of organic matter contained in the flowing current, and of further purifying the effluent liquid.

Claim 4 of the patent reads:

The process of liquefying the solid matter contained in sewage, which consists in secluding a pool of sewage having a non-disturbing inflow and outflow from light, air and agitation until a mass of micro-organisms has been developed of a character and quantity sufficient to liquefy the solid matter of the flowing sewage, the inflow serving to sustain the micro-organisms, then subjecting said pool under a non-disturbing inflow and outflow and under exclusion of light and air to the liquefying action of the so-cultivated micro-organisms until the solid organic matter contained in the flowing sewage is dissolved, then subjecting the liquid outflow to an aerating operation, and then to a filtering operation.

We make the foregoing statement not only for the purpose of pointing out to your readers that there are two sides to this question, but also to invite their attention to the fact that the decision of the U. S. Circuit Court of Appeals is merely a statement of the court's reason for sustaining the process claims of the patent and should not be taken as in any sense superseding those claims. The patent itself is so clear and distinct that there can be no reasonable ground for doubt or uncertainty either as to the scope of the claims themselves or as to the intent and meaning of the court's decision when considered with them. Any questions arising should be decided by competent patent counsel.

Cameron Septic Tank Company,
H. D. Wyllie, General Manager.

Monadnock Block, Chicago, Ill.,
Aug. 22, 1908.

Concerning a Forestry Bureau Circular on Wood Paving.

Sir: The growing tendency of the governmental departments at Washington to extend their activities into fields outside of their legitimate domain is becoming more and more noticeable. As might be expected, when a department organized to deal with one particular class of technical subjects undertakes to deal with other, not closely related subjects, inadequate and incompetent treatment is likely to, and often does, result, and errors and misstatements are likely to be found in the government reports and publications relating thereto.

The latest instance brought to the notice of the writer is the publication of Circular 141 of the Forest Service Bureau of the Department of Agriculture, under the title of "Wood Paving in the United States." The author of this circular not only assumes to constitute himself an expert on street paving, but his enthusiasm leads him into a position of open advocacy of a certain kind of pavement to a degree entirely inconsistent with his position as an official of the Government. To the intelligent citizen who has no special knowledge of the subject of street paving the impression is inevitably conveyed that, upon the whole, wood pavement is superior to any other kind of pavement for use on city streets.

Whether this be the fact or not is immaterial for our present consideration. The point is that it is entirely foreign to the function of the Forest Service Bureau to undertake to deal with the relative merits of different varieties of street pavement; and particularly so to marshal facts and statements as to give the general reader an impression that is not sanctioned by the judgment of a majority of engineers and experts who, by special study and large experience, are best qualified to express opinions on the relative merits of the different pavements in use.

It is true that the author modestly puts forth some of the erroneous statements and conclusions contained in the circular as being the average of the opinions expressed by ten municipal engineers upon the relative merits of different pavements. With these opinions, and the right of their holders to express them, we can have no quarrel. But when they are put forward by a government bureau, under official approval, in a public document, to support an apparently desired and possibly pre-determined conclusion, there is reason for grave criticism. If the disinterested opinion of the profession was wanted, why confine the inquiry to ten engineers when there are ten times that number who may be equally competent to express opinions? Why, if only ten engineers were to be referred to as authorities, were their names not given, so that the public might judge of the weight to be attached to their opinions?

These questions are especially pertinent when some of the conclusions based upon, or at least to be inferred from, these ten opinions are considered. A great majority of the city engineers whose knowledge and experience qualifies them to speak on the subject would hardly corroborate the assertion that under normal and average conditions asphalt block pavement is 40% more durable than sheet-asphalt pavement; or that granite block pavement is but 43% more durable than wood pavement; or that the resistance to traction on brick pavement is more than 10% greater than that on wood pavement; or that in sanitary qualities, asphalt block pavement is inferior to wood pavement; or finally, that considering all the qualities that go to make a street pavement economical and desirable, wood pavement stands at the head of the class.

The circular might be fairly criticized and its erroneous statements pointed out on many other points, but it is unnecessary to take up space for the purpose here.

The serious objection to the publication is that it will doubtless mislead great numbers of intelligent people who have no special knowledge of the subject. They will naturally attach weight and importance to statements and conclusions put forth by a government bureau with the approval of a member of the Cabinet.

Lest the motive of the writer be misunderstood, permit him to say that he has no desire or intention to discredit the merits of creosoted wood block pavement. It has many desirable qualities and for some locations and conditions is almost ideal. It is good enough to stand on its own merits without governmental boosting. In its present form it is a comparatively new pavement, and in some important qualities it must be still considered on trial. Its durability under the severe stress of heavy city travel is yet to be determined. This is admitted by the author of the circular when he says "There is in the United States almost no wood pavement of the modern kind which has yet been down long enough to show its durability. The values assigned by the engineers to durability are, therefore, based principally on general impressions and inference from European experience." He might have added that the testimony obtainable from cities abroad is conflicting and inconclusive. Time will be required to settle this question of durability in our American cities, and in the meantime the Forest Service Bureau, if it is to continue the rolé of expert adviser on street paving, should await developments before publishing official opinions on the subject.

It seems a little singular that the Forest Service Bureau, which was organized to study and promote Forestry and to conserve the timber supply in the United States, should be advocating the use of timber in new fields, thus hastening the exhaustion of our supply.

S. Whinery.

95 Liberty St., New York, Aug. 12, 1908.

[We agree with Mr. Whinery in some of his criticisms, particularly those pertaining to the erroneous deductions that may be drawn from the comparative tabular data. These deductions, and perhaps some other portions of the circular, illustrate the need of having all government publications of this sort prepared, or at least edited, by experts in the lines ventured upon, particularly when those lines reach into what some may consider to be outlying fields.

We think Mr. Whinery lays too much stress on the circular being a plea for wood as against the other forms of pavement, and that he would like to set too narrow limits on the technical investigations and on the publicity work of government departments. We also think he quite misconceives the scope of the work of the U. S. Forest Service if he thinks it either is or should be limited to conservation. Forests should be conserved for profitable use, and it is an important and valuable service to tell how their products may be used most profitably, and even to present well-considered reasons why the products of the forest are superior, for certain purposes, to those of the mine or quarry.

We agree with Mr. Whinery that the value of the tabular statement of the relative merits of different kinds of pavements might be more readily judged if the names of the engineers had been given, although this would really matter but little except to other engineers. As to giving the opinions of only ten engineers, it should be remembered that, to quote from the circular, "opinions were sought from engineers of a number of American cities who have had experience with the modern creosoted block pavement." * * * It would really be interesting to know how many engineers there are in America who could properly be called experts on wood pavement.

For the benefit of those who have not seen the circular we may state that, among other topics dealt with besides those criticised by Mr. Whinery, the circular outlines tests of different kinds of paving woods now being carried out on the streets of Minneapolis, jointly by the U. S. Forest Service, the city named and two interested companies.

Finally, those who have not seen the circular, may obtain a copy, if they wish, by addressing the Forest Service, U. S. Department of Agriculture, Washington, D. C.—Ed.]

Notes and Queries.

In the article on "Concrete Paving for Streets," in our issue of Aug. 20, the invention of the "granitoid concrete block pavement" was attributed to Mr. Rudolph S. Blome. We are informed that it is the joint invention of Mr. Blome and Mr. Sinek, who are the members of the Rudolph S. Blome Co., of Chicago.

A REINFORCED-CONCRETE LIGHTHOUSE, built in the Straits of Malacca by the government of the Straits Settlement and recently described in "The Engineering Review" of London, is an interesting construction. The new lighthouse, which is situated in a very rough waterway with a 25-ft. mean depth and a 14-ft. tidal range, consists of a two-story octagonal house carried on concrete piles some 20 ft. above mean water and surmounted by a pyramidal skeleton column construction which carries the lantern about 92 ft. above mean high water. The foundation piles, which were made 15 miles from the site and transferred on hogshead rafts, were originally 50 ft. long and from 18 to 24 ins. square, with a small hollow interior and reinforced with 1¼-in. longitudinal rods. On driving it was found that this length was insufficient so the hollow was filled and a 13-ft. addition made to the length, the new reinforcement being laced tightly to the old. With these new piles, by the use of the water jet, hard bottom was reached at an average penetration of 26 ft., that is, 52 ft. below mean high water. The piles were placed in an octagonal form, having a center pile 24 ins. square, afterward protected by a 5-ft. concrete filled cylinder, an inner ring of 18-in. piles at a radius of 9 ft. 9 ins., and an outer ring of 24-in. piles at a radius of 20 ft. At a depth of 24 ft. m. h. w., these foundation piles were connected, radially and circumferentially, by steel girders protected by concrete, and well clamped to the extended reinforcement of the piles. On top of the piles circular concrete columns, with reinforcement overlapping that of the piles, were carried up 21 ft. to the first floor elevation, being braced by concrete beams at two points in this height. The house proper is of the ordinary reinforced-concrete construction, as is also the pyramidal skeleton on which the lantern is carried.

The entire structure was designed by Mr. O. P. Thomas, agent in Singapore for the Colonial Ferro-Concrete Syndicate.

THE PUMPING PLANT OF THE HUNTLEY IRRIGATION PROJECT.

By F. W. HANNA.*

In the construction of extensive irrigation canals it usually becomes necessary to drop the canal bed from one level to another to prevent excessive slopes and consequent high velocities. Where such a drop is considerable and the canal is of fair size the development of water power is an easy matter. In connection with the large irrigation projects under construction by the United States Reclamation Service, many uses can be found for power for industrial and irrigation purposes. Where a perennial flow is maintained in the canal, the power can be used for general industrial purposes, but where the flow is continued only through the irrigation season the useful applications of the power are limited. Evidently where the power can be utilized for pumping water for irrigation purposes the highest benefit will result. This is the use to which the Huntley plant is put, the hydraulic power being applied without the intervention of electrical machinery.

The Huntley project is located on the bottom lands of the Yellowstone River a few miles below Billings, Mont., in the Reclamation Service district in charge of Mr. H. N. Savage, Supervising Engineer. As shown in Fig. 1, the main canal diverts, without the use of a dam, 500 sec.-ft. of water from the Yellowstone River, at a point about three miles above Huntley, for the irrigation of 29,000 acres of land, about 25,000 of which are covered by a gravity system and the remainder by a pumping system. After traversing a distance of about 14 miles, the main canal drops 33½ ft. to lower bench lands, and it is at this point that a pumping plant is installed. As the power is used without intermediate electrical development, this plant is typical of a number of plants likely to be constructed by the Reclamation Service.

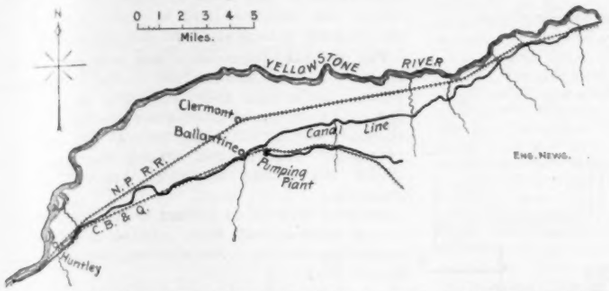

FIG. 1. GENERAL LOCATION OF CANALS AND PUMPING PLANT. HUNTLEY IRRIGATION PLANT, HUNTLEY, MONTANA.

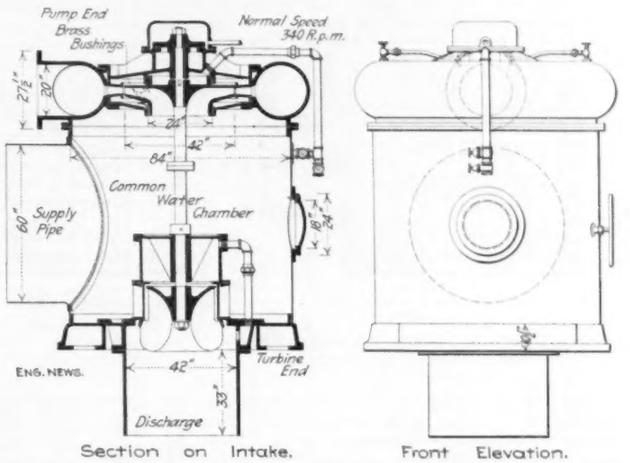

FIG. 3. SECTION OF TURBINE PUMPING UNIT. HUNTLEY IRRIGATION PROJECT.

As seen in Figs. 2 and 3, the pumping plant contains two vertical-shaft pumping units, each consisting of an inward-downward flow turbine directly connected with an upward-outward flow centrifugal pump of 28 sec.-ft. capacity, inclosed in a common case with a central water chamber supplied by a 63½-in. pressure pipe. The turbines are provided with cylinder gates and the pumps are of the closed runner type. The shaft of each pumping unit is provided with a guide bearing placed immediately above the gate chamber and a combined guide and water-lift thrust bearing situated above the pump for supporting the weight of the revolving parts or such portion thereof as may exist when the system is in operation.

The pressure for each water-lift bearing is obtained through two pipes leading from the whirlpool chamber of the pump to an annular chamber in the bearing support. The entrances to these pipes are provided with strainers perforated with holes 1/16-in. in diameter so as to eliminate debris from the water before reaching the bearing chamber. The water is forced by the whirlpool pressure through the pipes into the annular space referred to, thence through openings in the supporting plate, beneath the bearing plate partly up into a cap dome and out through a small drain pipe and partly down through the steady bearing into a second annular chamber above the impeller. To decrease the downward thrust of the revolving parts when starting and to discharge the flow of water through the steady bearing, the annular space above the impeller is provided with a drain pipe so that it may be entirely relieved of pressure. This pipe is also connected with the supply chamber (see Fig. 3) for the purpose of equalizing the pressures in this annular space and in the supply chamber when under operation. The

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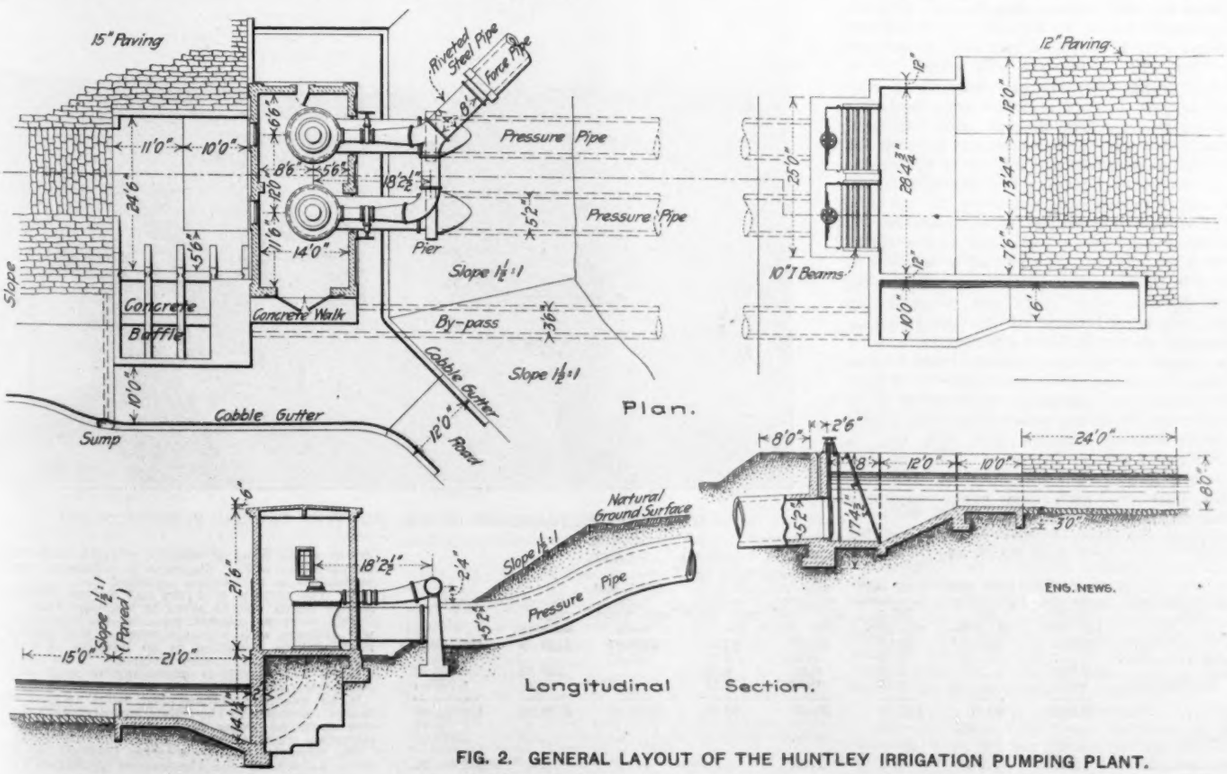


FIG. 2. GENERAL LAYOUT OF THE HUNTLEY IRRIGATION PUMPING PLANT.

fact that the pumping units are so placed as to give a static pressure of about 20 ft. on the suction side of the impellers is an important factor in a starting unit. Until sufficient water pressure has been developed in the whirlpool chamber of the pump to raise the water-lift bearing off its seat, it is essential that this bearing be relieved of downward thrust. This relief is accomplished by utilizing the 20-ft. head acting on the lower surface of the impeller, while the corresponding upper surface of the impeller is subjected only to atmospheric pressure as explained above. When the unit is running at full speed, the upper side of the impeller is closed to the air and opened to the supply chamber, thus balancing the pressures on the top and bottom surfaces of the impeller and throwing the weight of the revolving elements on the water-lift bearing. The water pressures on the turbine runners are balanced by means of pipes connecting their upper surfaces with the draft tubes below.

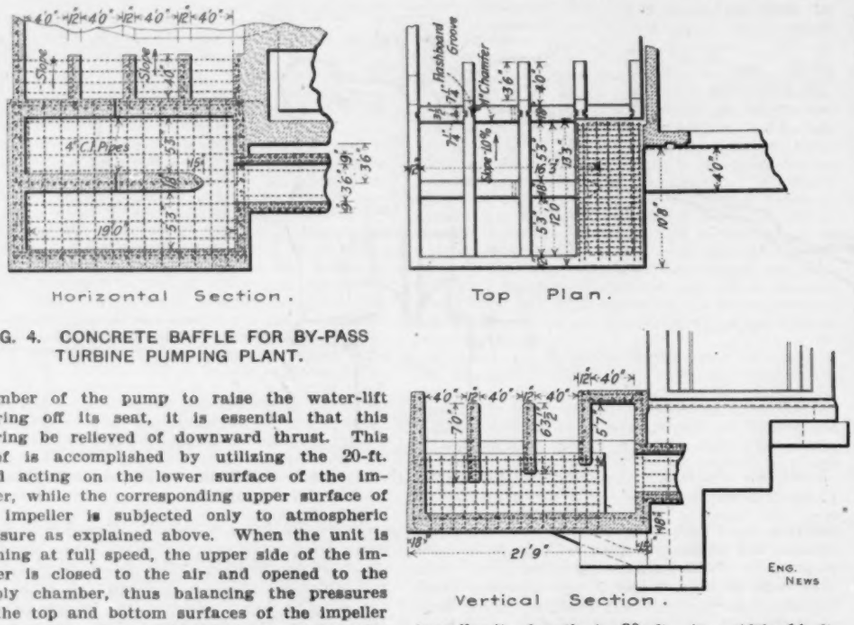


FIG. 4. CONCRETE BAFFLE FOR BY-PASS TURBINE PUMPING PLANT.

The total head on the turbines is 33½ ft., 26½ of which is pressure head and 7 is draft tube head; the total pump lift above the supply is about 48½ ft., 3 of which is the result of friction losses in the discharge pipe. The water in the supply pipes causes a pressure of about 20 ft. on the suction side of the impellers as already noted, the pumps being below the supply source. The lift or operative pressure on the discharge side is therefore 68½ ft.

The supply canal terminates in a concrete structure, Fig. 4, having a spillway on one side connecting with a by-pass pipe about 220 ft. long discharging into the canal below the power-house through a concrete baffle chamber. The by-pass pipe is constructed of reinforced concrete and has an internal diameter of 49½ ins. and a thickness of 9 ins. Protected by screens and controlled by gates at the end of the concrete structure are the entrances to the two reinforced concrete supply pipes, each having an internal diameter of 63½ ins. and a thickness of 9 ins. These pipes run for a distance of about 100 ft. approximately along the contour of the ground, where they are connected to riveted steel pipes leading into the common supply chamber of the turbines and pumps.

The pumps discharge through riveted steel and cast iron pipes, each controlled by a gate valve. These two discharge pipes unite at a short distance from the power-house and empty into a reinforced concrete pipe 49½ ins. in diameter and 9 ins. in thickness. This concrete pipe has a length of about 1,385 ft. and discharges into the high line canal supplying irrigable bench lands above.

The turbines discharge into the canal below through concrete draft tubes forming a portion of the power-house and pumping machinery foundation. The power-house itself is constructed of plain and reinforced concrete. Internally its length is 30 ft., its width 14 ft. and its height 20 ft. The walls are 12 ins. thick and are composed of plain concrete while the roof is built of reinforced-concrete beams and slabs. In the upper portion of the house supported on steel frame work is installed an I-beam traveler with a 5-ton chain block for handling the pumping apparatus in case of repairs.

The complete cost of the pumping units, including the supply pipe and their headgates, frames and controlling mechanism, the metal intake connections between the supply pipes and chambers, the discharge pipes with their controlling valves, the draft tubes and the repair handling apparatus, was $12,675. The construction of the concrete intake structure, the concrete pipes and the power-house and all excavating, paving and other work in connection with the plant were done on government force account for $38,753.75. This makes a total cost of of $51,428.75, amounting to about $12.85 per acre of the present irrigable area served by the plant. An extension has been surveyed that will increase the irrigable land by about 2,000 acres and thereby reduce the unit cost somewhat.

The pumping apparatus was furnished under contract by the Camden Iron Works, of Camden, N. J., and is now under operation on the project. The combined guaranteed efficiency of the turbines and attached pumps was 55% and the results of the required 60-day operating test shows the actual efficiency well within the guaranty.

[It is of interest to append to Mr. Hanna's article a table of cost data, relating to this plant, appearing in the "Reclamation Record," July issue.—Ed.]

FIG. 5. CONCRETE POWER-HOUSE, HUNTLEY TURBINE PUMPING PLANT.

COST DATA RELATING TO HUNTLEY PUMPING PLANT.

Distribution of cost.	Unit cost excavation 22,285 cu. yds.	Unit cost puddling 200 cu. yds.	Unit cost concrete 785.1 cu. yds.	Unit cost 49½-in. concrete pipe 1,607 lin. ft.	Unit cost 63½-in. concrete pipe 355.2 lin. ft.	Total cost iron and wood work.	Total cost miscellaneous.	Totals.
Labor	$0.524	$0.37	$6.17	$2.95	$2.51	$254.97	$429.99	$23,506.71
Materials	.....	.....	5.05	3.43	4.12	240.43	.....	12,133.99
Supplies	0.012	.....	0.10	0.05	0.06	.....	240.69	595.03
Plant depreciation	0.027	.....	0.32	0.16	0.21	.....	45.58	1,289.94
Totals	$0.563	$0.37	$11.64	$6.59	$6.90	$495.51	$716.26	$37,625.66
Paving	.....	.....	.....	.....	.....	.....	.....	54.42
Engineering	.....	.....	.....	.....	.....	.....	.....	1,073.67
Grand total	.....	.....	.....	.....	.....	.....	.....	$38,753.75

DUPLICATION OF CITY LIGHTING SYSTEMS under special conditions is being permitted by the Public Service Commission of the Second District of New York. In granting a petition of the Citizens' Electric Service Co., of Bath, N. Y., for permission to begin construction and render service in Bath, Avoca and Savona, the Commission makes the following statements:

(1) The service rendered by the existing company for several years has been very poor.

(2) The management has been indifferent to the needs of Bath and has not fulfilled its contractual duties to the village in respect to the street lighting, its failures in that regard being gross and inexcusable.

(3) The plant of the existing company is antiquated and dilapidated in many particulars. Some recent improvements have been made, but not of a character and extent adequate to make the plant as a whole equal to the fair requirements of the village.

(4) There is a considerable demand for daylight or power service in Bath. Neither company shows the extent of the same or whether it would be remunerative or unremunerative. Applicant is willing to furnish it; respondent is not willing to afford it.

(5) The villages of Avoca and Savona desire electric service which will be given by applicant only.

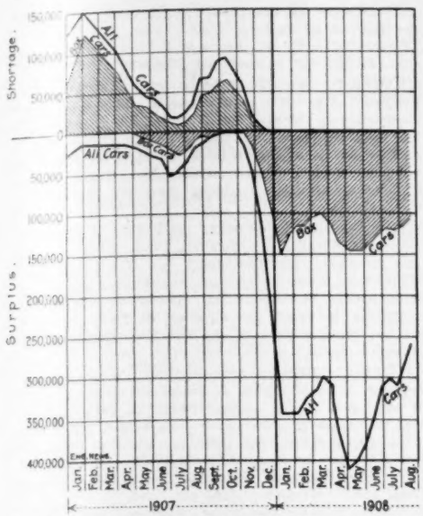
Held, that no general rule can be formulated which will indicate with precision when a new lighting company will be permitted to do business in a field already occupied by another company. That the circumstances and conditions prevailing in each case must control the decision.

If an existing company has failed to properly discharge its duties to the public and does not put its service upon the proper basis, it is entitled to little consideration when it seeks to exclude competition.

The principles laid down in the Lockport and Katonah cases decided by the Commission reaffirmed.

UNEMPLOYED FREIGHT CARS IN DIAGRAM.

The Committee on Freight Car Efficiency of the American Railway Association has supplemented its latest report of freight-car surplusage by a diagram of the shortages and surpluses for the entire period from January, 1907, to date. As will be remembered, an acute shortage of cars marked the early part of 1907, while in the third quarter of the year a phenomenally sudden drop



Freight-Car Shortage and Surplus, January, 1907, to August, 1908.

(From a diagram prepared by the Car Efficiency Committee of the American Railway Association.)

in demand converted the shortage into a glut or surplusage within the short space of a few weeks. The course of this notable change is shown in striking manner by the diagram, which we reproduce herewith in slightly modified form. Besides the general course of the lines, there are several matters of interest in the diagram, for example, the large percentage of hopper and gondola cars in the surplus as compared with their share in the shortage; the general parallelism of the curves for the corresponding seasons of the two years shown; the later appearance of the Spring demand for cars in 1908 than in 1907, and the early appearance of the fall decline in 1907.

THE COAL BRIQUETTING PLANTS in the United States produced, in 1907, an output of 63,153 short tons, having a value at the plant of $244,942. According to the U. S. Geological Survey bulletin, from which these figures were obtained, there were ten such plants in operation in this country in 1907.

REINFORCED CAST-IRON PIPE is among the exhibits at the British and French Exhibition now being held in London. According to "The Engineer," of London, the pipes are 5 ft. inside diameter, and are reinforced by steel hoops which are set in position while hot. Whether they are shrunk upon the pipe or placed in the mold so as to be embedded in the cast-iron shell does not appear. Presumably they are embedded in the pipe as they are said to provide strength to resist both internal and external pressure. The pipe is manufactured by the Société Anonyme des Hauts Fourneaux et Fonderies, of Pont-a-Mousson, France. The company has three large foundries, and operates its own iron mines and blast furnaces. The waste gases from the furnaces are used to operate gas engines forming the greater part of the power plant.

AN ELEVATED RAILWAY EXTENSION in Chicago is to be built by the Northwestern Elevated Ry. in order to relieve the congestion of traffic on the elevated terminal loop. The extension will be on the north side of the river, on North Water St., which street runs close to the river bank and is occupied by railway freight tracks. The extension will be at right angles to the main line on Wells St., and will run to a terminal at Clark St., a distance of two blocks. The terminal station will be level with the viaduct approach to the Clark St. bridge over the river. This terminal will be convenient to the northern part of the business district. Some of the trains will use this new terminal, while others will continue to use the loop as at present.

AN IMPROVED METHOD OF SAW-TOOTH ROOF CONSTRUCTION.*

By SAMUEL M. GREEN.† M. Am. Soc. M. E.

While the sawtooth system of roof construction has great advantages where a good light is essential, as in weave sheds, it is admittedly troublesome in the American climate on account of leakage and condensation. Following are the important details of a new type of weave shed roof whose construction remedies these troubles.

Fig. 1 is a detail of the gutter, glass, stile and ridge construction, as adopted for this weave shed. It will be noted that the toe of the truss is supported by an I-beam column and that the gutter is supported by light cross beams. These beams are set at different heights in the length of the gutter, so that proper pitch is obtained from the high point of the gutter to the point where the water is taken down.

The curb or bottom part of the skylight sash is made of 4-in. Michigan pine, bevelled at a sharp angle at its top to permit the water of condensation to readily run off the curb, and it is also grooved at the lower part of this bevel to form a drip edge, so that all condensation on the glass will drip into a small copper gutter which is carried the whole length of this sill. This copper gutter is connected by means of small lead pipes to the regular roof downtakes.

The gutter proper is made as follows:

The corners formed between the bottom of the gutter and the curb on one side, and the gutter and the flat roof on the other, are filled with a fillet of wood of curved shape. Then sheet asbestos 1/16-in. thick is laid, extending up to within 3 ins. of the glass on one side, and 2 ft. on the flat roof on the other side. On this asbestos is then laid galvanized iron of about No. 24 gage, extending to the same height as the asbestos paper. This galvanized iron is nailed to the roof. The gutter is now ready to receive the regular five-ply or pitch roofing. Immediately under the lower end of the glass there is a flashing of galvanized iron, which is cut into the sill of the skylight by a specially prepared tool. This iron extends down and over the roofing material.

The stiles or bars of the skylight were made of white pine, firmly fastened to the curb and ridge with brass screws. Both the curbing and stiles were kiln dried and were shellacked before delivery on the roof.

The glazing is double; the inside light is of ¼-in. factory ribbed glass, and the outside of plain double-thick

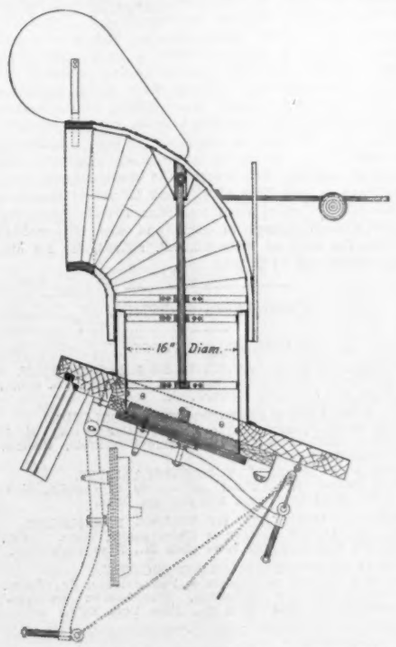


Fig. 2. A Ventilator Designed for use on Weave Sheds.

glass. The outside glass is held from slipping downwards by means of brass screws. Both lights were thoroughly bedded in putty and the outside light was properly drawn. The putty used contained 33⅓% of white lead. The gutters are drained at various points throughout their length.

VENTILATING AND HEATING.—This shed is heated, for reasons of economy, by direct radiation, steam pipes running around the walls of the building near the floor, and also lengthwise of the building, underneath the skylights. For ventilating, cooling and humidifying, two steel plate blowers, having wheels of 90-in. diam. and 48-in. face, were installed in the basement. Each is driven by a 25-HP. motor at 150 r. p. m., at which speed the builders' rating credits them each with 48,000 cu. ft. of air per minute. For cooling and humidifying the air in the summer there is a system of spray nozzles placed

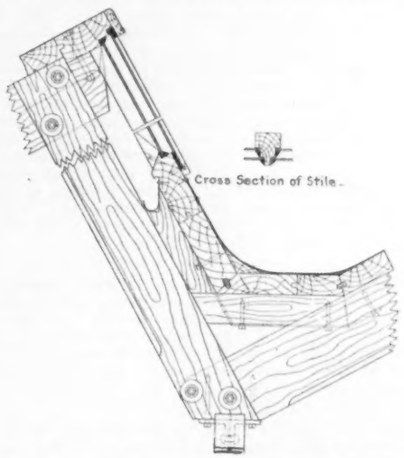


Fig. 1. Gutter Construction for Sawtooth Roofs.

in the conduit through which the air from outside is drawn by the fans. There are 48 of these nozzles and they require 30 gals. of water per min. under about 40 lbs. pressure. After the air passes through this fine spray of water it encounters baffle plates which remove the entrained water. The air is delivered by the fans into galvanized iron conduits which deliver into the weave room, about 8 ft. above the floor.

On each sawtooth there are provided four 16-in. ventilators. Roof ventilators have been a constant source of annoyance, owing to the fact that they condense the moisture from the outgoing air, which drips into the room below. To obviate this difficulty these ventilators were designed as is shown by Fig. 2. The walls of both the stationary and revolving parts are made double and the space between is filled with non-conducting material. In order to tightly close the ventilators, to prevent condensation in winter, a damper was designed as is shown in this figure. This damper shuts against soft packing and has proved satisfactory. A slight amount of condensation, however, has occurred even with this tight-closing damper, and this is cared for by a metal trough, as shown, into which the condensation drips. It alternately collects in this trough and re-evaporates.

A MINE FIRE in Hailey-Ola Coal Mine No. 1, near Haileyville, Okla., Aug. 26, destroyed the hoisting shaft and air shaft and caused the suffocation of 25 miners. The fire had its origin in the ignition and subsequent explosion of a barrel of oil.

A RUNAWAY MINE CAR at the Warrior Run Colliery of the Lehigh Valley Coal Co., Aug. 28, caused the death of five miners. A car filled with men was being hauled, at the end of the day's work, up a 2,000-ft. slope running from the surface to a vein 900 ft. below. When about half way up the slope, this car was struck by the runaway car laden with refuse and traveling at a speed estimated at 40 mi. per hr. The two cars then plunged together to the bottom of the slope. The car of refuse is said to have been run out of a side slope on to a branch track, contrary to orders, while the other car was coming up, in order that it might be sent down as soon as the ascending car had passed. Becoming unmanageable it ran down the branch track and jumped the switch onto the main track.

A FIRE IN NEW ORLEANS Aug. 30 destroyed a number of wholesale houses and manufacturing plants near the intersection of Bienville and Chartres streets. The alarm was turned in shortly before 3 p. m., at which time the firemen of the city were in the midst of their annual picnic at a suburban park. Reports state that a mere handful of men had been left in charge of the engines, and their work was further complicated by an inadequate supply of water. The section devastated was composed largely of old buildings, some of which had been in use for more than half a century.

THE OIL WELL FIRE which has been burning near Tampico, Mex., for two months was extinguished Aug. 30. The fire is said to have been smothered by gravel

*Abstract of a paper presented at the annual meeting of the National Association of Cotton Manufacturers, at Boston, Mass., April 16-17, 1908.

†Consulting Engineer, Holyoke, Mass.

and mud which was pumped into the mouth of the well continuously for ten days. It is estimated that 3,000,000 bbls. of oil were burned. The oil is again flowing, having worked its way to the surface through the material used for extinguishing the fire.

CLOUDBURSTS in the northern part of New Mexico, Aug. 27, destroyed Folsom, a village of 600 inhabitants, and swept away 15 houses of the town of Raton. Eleven persons were drowned at Folsom.

OVERHEAD HIGH-TENSION WIRES IN NEW YORK City were reported in the course of the hearing noted just above, as follows, in addition to the 10.4 miles of the New York Central: Long Island R. R., 40 miles; Manhattan borough, 1 mile; Brooklyn borough, 145 miles; Bronx borough, 92 miles; Queens borough, 172 miles; Richmond borough, 150 miles. The total is about 610 miles. This includes about 500 miles at potentials of 1,000 to 3,000 volts, and about 100 miles at potentials from 3,000 to 11,000 volts. With the exception of the Long Island R. R. and New York Central lines, these overhead lines are used for electric light or trolley service and are strung along public streets.

THE NORTHWEST FOREST FIRES which destroyed the towns of Fernie, Hosmer and Michel, as noted in our issue of Aug. 6, continued for several weeks after that date, and destroyed great amounts of standing timber. During the month there were also many extensive fires in Montana, especially in the Lolo and Coeur d'Alene reserves.

THE SOUTHERN FLOODS which began Aug. 24 and 25 produced the greatest localized damage at Augusta, Ga. Nearly the entire city was flooded as a result of a phenomenally high stage of the Savannah River and the breaking of a power-dam just above the city. Several railway bridges near Augusta and a number throughout Georgia, South Carolina and North Carolina were wrecked, and many washouts of railway embankments occurred, resulting in several train wrecks. The loss of life from the floods in the three states named will exceed a hundred. The Weather Bureau reports that the Savannah, the Catawba, the Pedee and the Wateree exceeded all previous flood marks by several feet, and several other rivers reached the highest stages previously recorded. The extensive interruption of railway, telegraph and telephone service, and in several cities, as Augusta, the failure of water supply, gas and electric light service, produced a complete paralysis, which, however, is being relieved very rapidly. In addition to the damage mentioned, however, great loss resulted from the destruction of cotton crops and the washing of soil.

THE WILLAMETTE RIVER BRIDGE of the Spokane, Portland & Seattle Ry. (originally called the Portland & Seattle, and described fully in our issue of Feb. 13, 1908, pp. 161-164) was completed in August. Its total length is about 1,750 ft. and it includes a drawspan, 521 ft. long c. to c. of end pins, and four 269-ft. fixed spans. The railway's bridge across the Columbia River is expected to be completed in the course of the present month.

THE HUDSON BAY RAILWAY PROJECT was endorsed to the extent of a hearty support to government officials favoring it in the recent provincial elections in the Province of Saskatchewan, Canada. Press reports state that surveying parties have already been started out to begin surveys.

PERSONALS.

Mr. W. H. Elliot has been appointed City Engineer of Eureka Springs, Ark.

Mr. H. A. Vaughan has been appointed Superintendent of the Texas-Mexican Ry. at Laredo, Tex.

Mr. W. C. Hayes has been appointed Superintendent of Locomotive Operation on the Erie R. R. He was formerly Superintendent of the Susquehanna division.

Mr. W. L. Tracy, a division master mechanic of the Louisville & Nashville R. R., has become Assistant Superintendent of Machinery of the Missouri Pacific Ry.

Mr. Luke J. Ferritor, Superintendent of the Springfield division of the Wabash R. R. at Decatur, Ill., has resigned to become General Superintendent of the Grand Trunk Ry. at Montreal.

Mr. Forest E. Cardullo, formerly Professor of Practical Mechanics at Syracuse University, has recently accepted the chair of mechanical engineering at the New Hampshire State College.

Mr. G. E. Carson, Master Car Builder of the Pittsburg & Lake Erie R. R., will take a like position with the New York Central & Hudson River R. R. Sept. 1 at West Albany, N. Y. He will be succeeded by Samuel Lynn, at present, car foreman.

Mr. G. W. Taylor, formerly Division Master Mechanic of the Atchison, Topeka & Santa Fe Ry. at Newton, Kan., has become Superintendent of Motive Power of the San Antonio & Aransas Pass Ry. at San Antonio, Tex., succeeding Mr. G. W. Butcher, resigned.

Mr. W. H. Wheeler, of Boston, England, has lately retired from the position of Borough Surveyor and Harbor Engineer of that town, after a service of 49 years. On his retirement he was presented by the Mayor of Boston with a heavy silver tray. Mr. Wheeler will reside hereafter at Bromley, Kent, England.

Mr. Edward J. Mason, Assoc. Am. Inst. E. E., has been elected Professor of Physics and Electrical Engineering in the University of Pittsburg to succeed Dr. S. N. Taylor, who will go to the University of Cincinnati. Mr. Mason received the degree of M. A. at Trinity College, Hartford, Conn., for graduate work in electricity and mechanics, and afterward became the assistant of Dr. Robb, Professor of Physics and Electrical Engineering of the Rensselaer Polytechnic Institute. Mr. Mason has also had considerable experience in practical engineering.

Obituary.

Ralph Johnson, a mining engineer, is reported to have been drowned July 8 while making explorations in the northwestern part of British Columbia. He was a graduate of the University of Minnesota and is believed to be Ralph I. Johnson, M. Am. Inst. M. E.

Elbridge H. Beckler, M. Am. Soc. C. E., dropped dead from cerebral hemorrhage Aug. 26 at the West Tunnel camp of the St. Paul Pass, which is being constructed for the Chicago, Milwaukee & St. Paul Ry. through the Bitter Root Mts. in Montana. Mr. Beckler was at one time Chief Engineer of the Great Northern Ry. and was afterward a member of the firm of Winston Bros. Co., contractors. Further reference to his career will appear in a later issue.

Antoine Henri Becquerel, the French scientist, died Aug. 25. Mr. Becquerel was born in 1852 and was educated at the Ecole Polytechnique, where he spent three years. His father and grandfather were eminent physicists. Henri Becquerel first attained prominence as the discoverer of the Becquerel rays. For his success in this discovery he received the Rumford Medal of the Royal Society of England. He was actively engaged at the Conservatoire des Arts et Metiers and was one of the chief engineers of the Department des Ponts et Chaussees.

Edward Fithian, Rear-Admiral, U. S. N., retired, died Aug. 29 at his home in Bridgeton, N. J. Admiral Fithian was born in New Jersey in 1820 and entered the Navy in 1848, when he was appointed a third assistant engineer. Three years later he became a second assistant engineer and was made a chief engineer in 1859. He was in charge of the motive power of the frigate "Susquehanna" of the East India Squadron, which visited Japan under the command of Commodore Perry in 1853-4, and was afterward on duty on the same vessel when she acted as the escort of the "Niagara" in the first attempt to lay an Atlantic cable in 1857. He served during the Civil War on the steam frigate "Roanoke" and in New York City, where he was in charge of construction of naval machinery from 1861-3. Chief Engineer Fithian retired in 1882, and was advanced in 1906 to the rank of Rear-Admiral, retired, for his services during the Civil War.

ENGINEERING SOCIETIES.

COMING MEETINGS.

CENTRAL STATES WATER-WORKS ASSOCIATION.
Sept. 15-17. Annual convention at Pittsburg, Pa. Secy., Wm. Allen Veach, Newark, O.

NEW ENGLAND WATER-WORKS ASSOCIATION.
Sept. 23-25. Annual convention at Atlantic City, N. J. Secy., Willard Kent, 715 Tremont Temple, Boston, Mass.

LEAGUE OF AMERICAN MUNICIPALITIES.
Sept. 30-Oct. 2. Annual convention at Omaha, Neb. Secy., John MacVicar, Des Moines, Iowa.

AMERICAN INSTITUTE OF MINING ENGINEERS.
Oct. 1. Annual meeting at Chattanooga, Tenn. Secy., R. W. Raymond, 29 West 39th St., New York City.

ILLUMINATING ENGINEERING SOCIETY.
Oct. 6-7. Annual convention at Philadelphia, Pa. Secy., Van Rensselaer Lansingh, Engineering Societies' Building, 33 West 39th St., New York City.

AMERICAN STREET AND INTERURBAN RAILWAY ASSOCIATION.
Oct. 12-16. Annual convention at Atlantic City, N. J. Secy., B. V. Swenson, 29 West 39th St., New York City.

RAILWAY SIGNAL ASSOCIATION.
Oct. 13-15. Annual meeting at Washington, D. C. Secy., C. C. Rosenberg, 12 North Linden St. Bethlehem, Pa.

ASSOCIATION OF RAILWAY SUPERINTENDENTS OF BRIDGES AND BUILDINGS.
Oct. 20-22. Annual convention at Washington, D. C. Secy., R. H. Reid, Lake Shore & Mich. Southern Ry., Cleveland, Ohio.

AMERICAN SOCIETY OF MUNICIPAL IMPROVEMENTS.
Oct. 20-23. Annual meeting at Atlantic City, N. J. Secy., A. P. Folwell, 239 West 39th St., New York City.

AMERICAN GAS INSTITUTE.
Oct. 21-23. Annual meeting at New York City. Asst. Secy., W. Bissell, 29 West 39th St., New York City.

AMERICAN ELECTROCHEMICAL SOCIETY.
Oct. 30-31. Fall meeting at New York City. Secy., Dr. J. W. Richards, Bethlehem, Pa.

PACIFIC COAST GAS ASSOCIATION.—The 10th annual convention will be held at Santa Cruz, Cal., Sept. 15-17.

ASSOCIATION OF AMERICAN PORTLAND CEMENT MANUFACTURERS.—A meeting will be held at Detroit, Mich., Sept. 14-16.

COLORADO SCIENTIFIC SOCIETY.—At the regular meeting to be held at Denver Sept. 5, a paper on "Smelter Fumes," by Franklin R. Carpenter, M. Am. Inst. M. E., will be read and discussed.

LAKES-TO-THE-GULF DEEP WATER WAY ASSOCIATION.—The third annual meeting will be held in the Auditorium at Chicago, Oct. 7-9. The afternoon of Oct. 7 has been set aside for a trip to Lockport. New officers will be elected at this meeting, at which an attendance of 3,000 delegates is expected. Wu Ting-Fang, the Chinese diplomatist, is among those who will address the convention.

THE NATIONAL SOCIETY FOR THE PROMOTION OF INDUSTRIAL EDUCATION.—Next annual convention at Atlanta, Ga., Nov. 19-21. An exhibition of trade school work from all parts of the United States will be a feature of the convention. The preparation of this exhibition is under the direction of Professor K. G. Mathewson, President of the Georgia School of Technology, Atlanta.

RAILWAY SIGNAL ASSOCIATION.—At the Chicago meeting, to be held Sept. 8, a paper by James S. Lang, M. Am. Soc. M. E., entitled "Practical Snow Melting" will be discussed. This paper deals with a new method of freeing switches from snow and ice. Sub-Committee No. 1 will present a report on "Malleable Iron Castings," "Gray Iron Castings," "Specifications for 1-in. Pipe and Couplings," "Machinery Steel and Wrought Iron Bars" and "Specifications for Signal Roundels."

THE NATIONAL ASSOCIATION OF COTTON MANUFACTURERS.—Semi-annual meeting No. 85 will be held Sept. 29-30 at Saratoga Springs, N. Y. Among the papers to be presented are the following: "Commutator Grinding," "Cotton Fiber Substance and Its Properties," "Importance of Forest Preservation for Manufacturers," "Low Pressure Steam Turbines," "Measurements of Power and Its Transmission," "Positive and Accurate Humidity Controlling Devices," "Textile Mill Power Plant."

AMERICAN INSTITUTE OF MINING ENGINEERS.—The annual meeting will be held at Chattanooga, Tenn., Oct. 1, instead of at Birmingham, Ala., Sept. 29, as formerly announced. The change is due to the existing labor troubles in the Alabama mines.

Among the papers to be presented are the following: Oct. 2, two separate papers on experience with the Gayley dry blast process, by Edward B. Cook, Pottstown, Pa., and T. W. Robinson, Chicago, Ill.; "Mr. Gayley's Invention," R. W. Raymond, New York; "Blast Pressure at the Tuyeres and Inside the Furnace," R. H. Sweetser, Columbus, Ohio; "The Relation of Slow Driving to Fuel Economy in Iron Blast Furnace Practice," John B. Miles, Philadelphia, Pa.; Report of the Institute Committee on Steel; various papers on economic geology. Oct. 3, "Pressure-Fans versus Exhaust-Fans," Audley H. Stow, Maybeury, W. Va.; "Requirements of a Breathing Apparatus for Mining Use," Walter E. Mingram, New York; "Sulphur Dioxide as an Agent in Fighting Mine Fires," Walter O. Snelling, Washington, D. C.; "The Management of Mining Operations," Joseph MacDonald, Guanajuato, Mex.; "The Treatment of the Gold Ores of Hog Mountain, Ala.," T. H. Aldrich, Jr., Birmingham, Ala.

WESTERN SOCIETY OF ENGINEERS.—At the meeting of Sept. 2 a paper was presented entitled "The Analysis of a Hydro-Electric Project," by H. von Schon. The program and list of meetings for the coming season has been issued, and includes the following papers: Sept. 25, "The Electrification of the St. Clair Tunnel," F. A. Sager; Oct. 7, "Methods of Studying the Heat Absorbing Properties of Steam Boilers," L. R. Stowe; Oct. 9, "Distribution of Light and Power," H. B. Gear; Oct. 21, "Macadam Road Construction," A. N. Johnson; Nov. 4, "Retaining Walls," I. F. Stern; Nov. 13, "Electrolytic Corrosion of Boiler Tubes," C. F. Burgess; Nov. 18, "The Work of the Engineering Staff of the Wisconsin Tax and Rate Commission," W. D. Pence; Dec. 2, "The Reconstruction of the Street Railway Tracks in Chicago," George Weston; Dec. 11, "Hydro-Electric Development in the Northwest," C. E. Freeman; Dec. 16, "The Improvement of the Upper Mississippi River," Col. C. McD. Townsend; Jan. 2, 1900, annual meeting; Jan. 8, Discussion on Electric Traction; Jan. 29, "Steel Castings," R. P. Lamont; Feb. 3, "A New Form of Concrete and Steel Construction," T. W. Schaub; Feb. 12, "Multiple Cable Distribution in Telephone Work," B. C. Groh. The meetings are held at the society's rooms in Chicago.

CONSTRUCTION NEWS

Supplement to ENGINEERING NEWS. New York, September 3, 1908.

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CONSTRUCTION NEWS.

PLANS AND SPECIFICATIONS ON FILE.

(denotes that this work is advertised in Engineering News.)*

The following Plans (P.) and Specifications (S.) are on file and may be seen at the office of The Engineering News Publishing Co., 220 Broadway, New York.

Bids close.	Work.	Place.	See issue.
9- 4	*Channel,	Boston, Mass (P. & S.)	8- 6
9- 5	Elevator,	Bremerton Wash....(S.)	8-13
9- 5	Elevators,	Norfolk, Va.....(S.)	8-20
9- 5	*Prison,	Portsmouth, N. H...(S.)	8-13
9- 8	*Paving,	Muskegon, Mich. (S)....	8-27
9- 9	*Water pipe,	Springfield, Mass.(S.)	8-13
9-14	*Dredging,	Norfolk, Va. (S).....	8-27
9-15	*Bridge,	Amsterdam, N. Y. (S)..	8-27
9-27	*Quarters,	Ft. Hancock, N. J. (P. & S.).....	9- 3
10- 8	*Lift bridge,	Wash., D. C. (S).....	9- 3

LIST OF CONTRACTS PENDING.

LIGHT, HEAT AND POWER PLANTS.

9- 8	Lighting,	Kenosha, Wis 8-13
9- 9	Motor,	Atlanta, Ga..... 8-27
9-10	*Elec. equip.,	White Plains, N. Y 8-27
9-10	Power-house, etc.,	Mansfield, O.. 8-27
9-14	Light franchise,	Asbury Park, N. J..... 9- 3
9-14	Lighting streets,	Hartford, Conn. 7-30
9-15	Elec. light plant,	Winnipeg, Man. 7-30
9-19	Light plant,	Tacoma, Wash..... 8-13
9-19	Power plant,	Xenia, Ohio..... 9- 3
9-24	Lighting,	Portsmouth, Ohio 9- 3

BRIDGES.

9- 5	Bridge,	Cleveland, Ohio 8-20
9- 5	Bridge,	Ringoes, N. J..... 9- 3
9- 7	Superstructure, etc.,	Chillicothe, Ohio 8-20
9- 7	Bridge,	Speidwell, Va..... 8-20
9- 7	Bridge,	Beaver, Okla.. 8-27
9- 7	Bridges,	Valparaiso, Ind..... 8-27
9- 7	Bridges,	Columbus, Miss..... 8-27
9- 7	Bridges,	Franklin, Ind..... 9- 3
9- 8	Bridges,	Manhattan, Kan..... 9- 3
9- 8	Approach,	Oroville, Cal 9- 3
9- 8	Bridges,	Crown Point, Ind..... 9- 3
9- 8	Bridge repair,	Salinas, Cal..... 8-27
9- 8	Bridge,	Rensselaer, Ind..... 8-20
9- 9	Bridges,	Ithaca, N. Y..... 8-20
9- 9	Bridges,	Ocala, Fla..... 8-27
9-10	Bridge,	Ashland, Ohio..... 8-27
9-10	Bridge,	Monongahela, Pa..... 8-27
9-10	Bridge,	Willow, Cal 9- 3
9-10	Bridge,	Wilkes-Barre, Pa..... 9- 3
9-10	Bridge,	Boston, Mass..... 9- 3
9-12	Bridge,	Lancaster, Ohio..... 9- 3
9-14	Bridge,	Independence, Kan..... 9- 3
9-14	Bridges,	Moscow, Idaho 8-20
9-15	*Bridge,	Amsterdam, N. Y..... 8-27
9-15	Bridges,	Great Falls, Mont..... 9- 3
9-16	Bridge,	Somerset, Pa..... 9- 3
9-16	*Bridge,	Morenci, Ariz..... 8-13
9-21	Bridge,	Pasadena, Cal..... 9- 3
9-29	Bridge,	Little Falls, Minn..... 9- 3
10- 8	*Lift Bridge,	Washington, D. C. 9- 3

BUILDINGS.

9- 4	Building,	Batavia, N. Y..... 8-27
9- 4	Hospital,	Indianapolis, Ind..... 9- 3
9- 5	Elevator,	Bremerton, Wash 8-13
9- 5	Prison,	Portsmouth, N. H..... 8-13
9- 5	Elevators,	Norfolk, Va..... 8-20
9- 7	Asylum,	Rochester, Ind..... 8-20
9- 8	Library,	Hartford, Conn..... 9- 3
9- 8	*School,	Cincinnati, Ohio..... 8-20
9- 8	*Vacuum system,	Wash., D. C... 8-13
9- 8	Building materials,	New York... 8-27
9- 8	School,	Philadelphia, N. Y..... 9- 3
9- 8	Laundry (Mfg. Pl.),	Frankfort, Ky 9- 3
9- 9	Repairs, etc.,	New York, N. Y... 9- 3
9- 9	Court-house,	Wash., Ind..... 8-27
9- 9	*Post-office,	Sheridan, Wyo..... 8-13
9- 9	Court-house,	Washington, Ind... 8-20
9-10	Post-office,	Kenosha, Wis..... 8-13
9-10	Y. M. C. A.,	Richmond, Va..... 8-27
9-10	School,	Ogdensburg, N. Y..... 9- 3
9-10	Building,	Lawrence, Kan..... 9- 3
9-10	Hotel,	Coalinga, Cal..... 9- 3
9-11	Iron work,	Washington, D. C... 8-27
9-12	Laundry,	Ft. Bayard, N. Mex. (Mfg. Pl.) 8-20
9-14	Engine house,	New York, N. Y.. 9- 3
9-14	Post-office,	St. Louis, Mo..... 8- 6
9-14	Barracks,	Boston, Mass..... 8-27
9-14	Waiting room,	New York 9- 3
9-15	Stable,	New York, N. Y. 9-13
9-15	Factory,	Graham, Mo. (Mfg. Pl.) 8-20
9-15	Buildings,	North Chicago, Ill.... 9- 3
9-16	Hospital,	Ft. Leavenworth, Kan. 9- 3
9-16	Post-office,	Youngstown, Ohio.... 8-13
9-17	*Vault,	Washington, D. C..... 8-13
9-17	*Post-office,	Escanaba, Mich..... 8-13
9-18	Vacuum system,	Rochester, N. Y. 8-20
9-19	Quarters,	Ft. Baker, Cal..... 9- 3
9-21	School,	Cleveland, Ohio..... 9- 3
9-21	Post-office,	Little Rock, Ark..... 8-20
9-22	Post-office,	Greenwood, S. C..... 8-20
9-22	Laboratory, etc.,	Ann Arbor, Mich. 7-23
9-23	Court-house,	Green Bay, Wis.. 6-18
9-23	*Houses,	Wheeling, W. Va..... 8-27
9-23	*Quarters,	Ft. Hancock, N. J.... 8-27
9-24	Plumbing,	Baltimore, Md..... 8-24
9-24	Quarters,	Ft. Standish, Mass..... 9- 3
9-28	*Post-office,	Dalton, Ga..... 8-20
9-29	*Post-office,	Bridgeton, N. J..... 8-20
9-30	Post-office,	Cape Girardeau, Mo. 8- 6
10- 1	*Post-office,	Charlottesville, Va.. 8-20
10- 5	Post-office,	Chippewa Falls, Wis. 8-27
10-10	Post-office,	Butte, Mont..... 8-20
10-19	*Post-office,	Porto Rico 9- 3

WATER-WORKS.

9- 3	Cleaning filters,	Philadelphia, Pa. 9- 3
9- 4	Water pipe,	Ft. Lincoln, N. Dak 9- 3
9- 4	Extending w-wks. system,	Garfield, N. J..... 9- 3
9- 4	Water-pipe, dam,	Benton, N. H.. 9- 3
9- 4	Wells,	Fort McPherson, Ga..... 8-20
9- 4	Standpipe,	Manchester, Mass... 8-27
9- 5	Water cribs,	Wellsville, Ohio... 8-27
9- 5	*Reservoir,	Gulfport, Miss..... 9- 3
9- 7	Dam, etc.,	Chambersburg, Pa.... 9- 3
9- 7	Conduits, mains,	Sturgeon Bay, Wis 9- 3
9- 7	*W.-Works,	University, Ala..... 8-20
9- 8	Pump,	Muskegon, Mich..... 8-20
9- 8	Water-works,	Holyrood, Kan..... 8-27
9- 8	W-wks. system,	Chicago, Ill.... 9- 3
9- 8	Wooden pipe, etc,	Salt Lake City, Utah 9- 3
9- 9	Artesian well, etc.,	Angel Island, Cal 9- 3
9- 9	*Pipe line,	Springfield, Mass 8-13
9-10	Water-works,	Gothenburg, Neb.. 9- 3
9-10	Covering c.-i. pipe,	Pleasantville, Pa. 9- 3
9-10	Reservoir,	Hopewell, N. J..... 9- 3
9-10	*Dam,	Stamford, Conn..... 8-27
9-11	Hydrants,	Portland, Ore..... 8-20
9-13	*Pipe,	Morenci, Ariz..... 8-13
9-16	Water system,	Oxford, Ohio 9- 3
9-19	Pumping plant,	Austin, Tex..... 9- 3
9-22	*W-wks. system,	Shortsville, N. Y. 9- 3
9-22	Lime, etc.,	Cincinnati, Ohio..... 9- 3
9-22	*Filters,	Reading, Pa..... 8-27
10- 5	Well,	Harrisonburg, La..... 8-20
10-12	*Filtration plant,	Evansville, Ind. 9- 3
10-14	Cast-iron pipe, etc.,	Vancouver, B. C..... 8-13

SEWERS.

9- 4	Sewer,	North Braddock, Pa..... 8-20
9- 5	Sewers,	Lorain, Ohio..... 8-27
9- 7	Sewer,	Kendallville, Ind..... 8-27
9- 7	Sewer system,	Columbus, Ind.... 8-27
9- 7	Sewer,	Mitchell, S. Dak..... 8-27
9- 7	Pipe sewer, etc.,	Cresco, Iowa.... 8-27
9- 8	Sewer,	Hackensack, N. J.... 8-20
9- 8	Sewer,	Normal City, Ind..... 8-27
9- 8	*Sewers,	Saranac Lake, N. Y.... 8-27
9- 8	Sewers,	Crookston, Minn..... 8-27
9- 8	Sewer,	Hudson, Wis..... 8-27
9- 8	Sewers,	Carroll, Iowa 9- 3
9- 9	Sewers,	Columbus, Ind..... 9- 3
9- 9	Sewers,	Brooklyn, N. Y..... 8-27
9- 9	Sewers,	Brooklyn, N. Y..... 8-27
9- 9	Sewer,	Oakland, Cal..... 8-27
9-14	*Sewer,	Washington, D. C..... 8-20
9-14	*Engines,	Wash., D. C..... 8-13
9-14	Sewers,	Steubenville, Ohio..... 9- 3
9-14	*Sewers,	Vicksburg, Miss.... 9- 3
9-14	W-wks. system,	New Haven, Mo. 9- 3
9-15	Canal,	Salt Lake City, Utah.... 9- 3
9-15	*Sewer,	Peoria, Ill..... 8-27
9-16	Sewer,	Oakland, Cal..... 9- 3
9-30	*Sewers,	Norristown, Pa..... 9- 3

STREETS AND ROADS.

9- 4	Road repair,	Cincinnati, Ohio 8-20
9- 4	Pavement,	Lewiston, Idaho.....8-27
9- 5	Roads, etc.,	Fort Mackenzie, Wyo 8-20
9- 5	Street impvt.,	Fond du Lac, Wis. 8-20
9- 5	Road,	Terre Haute, Ind..... 8-13
9- 5	Road,	Biddeford, Me..... 9- 3
9- 7	Roads,	Hartford, Conn..... 9- 3
9- 7	Grading,	Jefferson, Iowa..... 9- 3
9- 7	Grading, etc.,	Belle Valley, Ohio 9- 3
9- 7	Roads,	Oakmont, Pa..... 9- 3
9- 8	Macadam, etc.,	Mt. Kisco, N. Y. 9- 3
9- 7	Road,	Danville, Ind..... 8-13
9- 7	Road,	Liberty, Ind..... 8-13
9- 7	Road,	Mankato, Minn..... 8-20
9- 7	Sidewalk,	Osceola, Iowa 8-20
9- 7	Grading, etc.,	Ingram, Pa..... 8-27
9- 8	*Paving,	Muskegon, Mich..... 8-27
9- 8	Resurfacing,	Muncie, Ind..... 8-27
9- 8	Roads,	Martinsville, Ind..... 8-27
9- 8	Roads,	Rockville, Ind..... 8-27
9- 8	Road,	Corydon, Ind..... 8-27
9- 8	Road,	Vincennes, Ind..... 8-13
9- 8	Gravel roads,	Washington, Ind.. 9- 3
9- 8	Stone road,	Covington, Ind..... 9- 3
9- 8	Macadam,	Columbus, Ind..... 9- 3
9- 9	Roads,	Muncie, Ind..... 8-13
9- 9	Regulating, etc.,	Brooklyn, N. Y. 8-27
9- 9	Road,	Bloomington, Ind..... 8-27
9-10	Asphalt walks,	New York, N. Y. 8-27
9-10	Road,	Lafayette, Ind..... 8-20
9-10	Fill and grade,	Willow, Cal..... 9- 3
9-10	Paving,	Cambridge, Ohio..... 9- 3
9-10	Grading,	New York, N. Y..... 9- 3
9-11	Gravel road,	Lafayette, Ind..... 9- 3
9-11	Gravel,	Cincinnati, Ohio..... 8-27
9-12	Grading,	Cleveland, Ohio..... 8-27
9-14	*Macadam,	Decatur, Ala..... 8-20
9-14	Gravel road,	Frankfort, Ind..... 9- 3
9-14	Grading, etc.,	Edgewater, N. J... 9- 3
9-14	Paving, etc.,	New York, N. Y. 9- 3
9-16	Paving, etc.,	New York, N. Y... 9- 3
9-18	Road,	Huntington, Ind..... 8-27
9-18	Gravel road,	Huntington, Ind.... 9- 3
9-19	Grading, etc.,	Cleveland, Ohio.. 9- 3
9-21	Sidewalks,	Canfield, Ohio..... 9- 3
9-25	Road,	Cincinnati, Ohio 9- 3
9-28	*Macadam, etc.,	Ft. Andrews, Mass 9- 3
9-29	Gravel roads,	Frankfort, Ind..... 9- 3

MISCELLANEOUS.

9- 4	*Dredging,	Plymouth, Mass..... 8- 6
9- 4	Copper wire,	Buffalo, N. Y. 9- 3
9- 5	Iron fence,	Chicago, Ill. 9- 3
9- 5	Drainage,	Woodstock, Ill. 9- 3
9- 5	*Lumber, etc.,	Charleston, S. C... 8- 6
9- 5	*Dredging,	Philadelphia, Pa..... 8-13
9- 5	*Drainage,	Annawan, Ill..... 8-20
9- 5	*Drainage,	Houston, Tex..... 8-27
9- 5	Motor trucks,	Washington, D. C..8-27
9- 7	Creosoted barges,	Memphis, Tenn.8-27
9- 7	*Embankment,	Greenville, Miss.... 8-13
9- 7	Levee,	Sacramento, Cal. 9- 3
9- 7	Retaining wall,	Rushville, Ind.... 9- 3
9- 7	Dam,	Port Arthur, Ont. 9- 3
9- 8	Rifle range,	Ottawa, Ont. 9- 3
9- 8	Fire alarm system,	Clinton, Ia.. 9- 3
9- 8	*Cement,	Vicksburg, Miss..... 8-20
9- 8	Dredging,	New Orleans, Ia..... 8-27
9- 8	Vacuum system,	Harrisburg, Pa. 8-27
9- 9	Lumber,	Washington, D. C..... 8-27
9- 9	Piles,	Washington, D. C..... 8-27
9- 9	Towboat,	Cincinnati, Ohio..... 8-27
9- 9	*Barge canal,	Albany, N. Y..... 8-20
9- 9	Sale of railway,	Atlantic & Lake Superior Ry. 7-23
9- 9	Sale of Ry.,	Baie des Chaleurs Ry. 8- 6
9- 9	Ditch,	Marshalltown, Ia 9- 3
9- 9	Ditch,	Paragould, Ark. 9- 3
9-10	Repairing boats,	New York..... 9- 3
9-10	Concrete dam,	Cincinnati, O..... 8-27
9-10	*Lighthouse foundation,	Wilmington, Del..... 8-27
9-12	Sale of electric railway property,	Mt. Vernon, Ohio 8- 6
9-12	Rock, cement, steel, etc.,	San Quentin, Cal. 9- 3
9-12	Rifle range,	Ottawa, Ont. 9- 3
9-14	*Dredging,	New York, N. Y..... 8-27
9-14	Wooden wharf,	Fort Sumter, S.C. 8-27
9-14	*Dredging,	Norfolk, Va..... 8-27
9-14	Lock gates,	Winnipeg, Man..... 8-27
9-15	*Ry. grading, etc.,	Paterson, N. J. ..... (Elec. Rys.) 9- 3
9-16	Riprap wall,	Oakland, Cal 9- 3
9-16	Levee, etc.,	Memphis, Tenn..... 8-27
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RAILWAYS.

ALBUQUERQUE EASTERN. — Arrangements have been completed, it is stated, for the construction of the Albuquerque Eastern Ry., from Moriarity, on the Mexican Central, to Frost, and from that point west to Albuquerque, and thence north to Hagan, N. Mex. When the line is completed it will be turned over to the New Mexico Central, and the entire enterprise will be reorganized. It will be 60 miles long. W. S. Hopewell is Gen. Mgr., Santa Fe, N. Mex.; J. R. Farwell is Ch. Engr., Albuquerque, N. Mex.

CANADIAN NORTHERN.—Proposed extensions in Saskatchewan and Manitoba include a line from Regina to the western boundary of Manitoba, connecting there with the company's line to Brandon, not exceeding 152 miles; from Saskatoon towards Calgary, not exceeding 175 miles; from Prince Albert to Battleford, not exceeding 132 miles; from the Thunder Hill line of the company's railway at the westerly boundary of Manitoba, in a western direction towards Rosthern, not exceding 100 miles; an extension of the Rosthern line from the western boundary of Manitoba in a northwesterly direction, not exceeding 50 miles. T. Turnbull is Asst. Ch. Engr., Winnipeg, Man.

COLORADO, OKLAHOMA & GULF.—It is reported that right-of-way has been secured for this railway. This line will connect Ardmore, Berwyn, Williford, Chickasha and Arapahoe, Okla. Among those interested are Wm. J. Carter, Rockefeller Bldg., Cleveland, Ohio; J. E. Parker, Atlanta, Ga.; C. W. Young, Memphis, Tenn., etc.

COLUMBIA RIVER, OUTLOOK & NORTHERN.—W. McF. Stewart, Pres. Outlook, Wash., advises us that construction contracts will not be let before December. It is planned to complete all surveys and the preliminary work of securing right-of-way this year. The proposed road will extend from Vancouver to Spokane, Wash., 300 miles.

DENVER & RIO GRANDE. — A special meeting of the stockholders of the Denver & Rio Grande R. R. Co. has been called for Sept. 10 in Denver, to authorize a $150,000,000 bond issue, to consider the purchase of about 14 small railroads in Colorado and Utah, and to provide for the raising of $15,000,000 at once by the issuance of short term gold notes. The meeting is to complete the financial arrangements connected with the consolidation of the Gould lines in Colorado and Utah. The bonds will be dated Aug. 1, 1908, and will mature on Aug. 1, 1955. The rate of interest to be paid on the bonds will be determined at the meeting. The stockholders will also consider and act on the question of issuing gold notes of the company, convertible into first mortgage gold bonds, to the amount of $15,000,000, to run for three years from August 1 of this year, with an option for extending them for five years from date of maturity. These notes are to be secured by bonds. Noted on Aug. 20.

EASTERN TOWNSHIP RY.—Chartered to build a railway from a point near the I. C. R. at St. Leonard Junction and run through the villages of St. Clotilde, St. Albert de Victoriaville, Arthabaskaville, St. Paul de Chester, Fecteau Mills, St. Audrieu to Dudswell Junction, on the Quebec Central Ry.

ERIE.—This company plans to spend about $15,000,000 on improvements, some of which are already under way, according to the New York "Tribune." These include the elimination of high grades to increase the carrying capacity of the road, cut-offs to lessen length of haul, readjustment of alinements and the Bergen Hill opening. The money for these improvements is exclusive of the heavy expenditure for maintenance of way which are being made. A low grade line is being constructed from Highland Mills, N. Y., on the Newburgh branch, through Campbell Hall and Otisville to Guymard, a short distance east of Port Jervis, where it joins the main line, a distance of 40 miles. The cost of this work will be about $6,000,000. The work includes a double-track tunnel more than a mile in length, and a viaduct over Moodna Creek 3,200 ft. long and 193 ft. high. By this route the present heavy grades over the Shawangunk Mountains east of Port Jervis will be avoided. It is expected that this improvement will be ready for business within six months. "A new line is also being built west of Jamestown, N. Y., known as the Columbus & Erie, at a cost of nearly $1,000,000. This will reduce a 35-ft. grade to two-tenths per cent eastbound and three-tenths per cent westbound, and eliminate a number of curves. The distance is 24 miles, part of which is already being used for traffic, and the rest will be completed soon. Work is also being pushed on the Genesee River Railroad from Portage, on the Buffalo division, to Cuba, N. Y., on the main line. The work being done is a reduction of heavy grades and the elimination of bad curvatures, at a cost of about $4,000,000. This will be finished early next year. Some of the construction includes a viaduct over the Genesee River, 3,120 ft. in length and 145 ft. in height, and another viaduct at Rush Creek 1,920 ft. long and 150 ft. high. Perhaps the most interesting work being done is the four-track cut through Bergen Hill to Jersey City, as this will materially assist the company in handling suburban business. Incoming and outgoing trains will be handled separately during the rush hours, with three tracks for incoming trains in the morning and three for outgoing trains at night. Through an arrangement of over and under crossings there will be no danger from collisions or side wipes from mistakes of switchmen. This improvement means relief from the discomforts of the present tunnel. The work will cost about $1,500,000 and will probably be finished within a year."

GRAND RAPIDS & NORTHWESTERN.—Contracts probably will be let this fall, we are officially advised, for building this railway. It will be 95 miles long and will run from Grand Rapids, Mich., northwesterly to Ludington, Mich. Marshall F. Butters is Pres., Ludington. Walter S. Syrett is Ch. Engr., Tacoma Bldg., Chicago. Surveys are made and right-of-way secured. Capital is partly obtained. Noted on July 30.

INTERCOLONIAL RY.—A commission has been named by Hon. George Graham, Minister of Railways and Canals, Ottawa, to investigate the condition, equipment and business prospects of the branch lines touching the Intercolonial Railway, in the provinces of Nova Scotia, New Brunswick and Quebec. The commission consists of E. Tiffin, Gen. Traffic Mgr., of the Intercolonial; D. A. Storey, Gen. Freight Agent of the Intercolonial; and U. A. Bowden, Engr., of the Railway Department at Ottawa. The investigation is preliminary to the acquisition, by lease or purchase, of the branches, which can be operated with profit to the Intercolonial and with benefit to the districts which they run through.

IOWA INTERSTATE.—Organized in Iowa, with headquarters in the Manhattan Bldg., Des Moines. The railway, as proposed is to run from Council Bluffs to Muscatine by way of Des Moines. The portion between Des Moines and Council Bluffs will be built first. It will not run directly through Des Moines, but will run into Des Moines from Springhill, by way of the army post. R. B. Bannister is Secy. and Treas.

KANSAS SOUTHERN & GULF.—Plans are in preparation for an extension from Omaha, Neb., to Wichita, Kan. This railroad is now ten miles long, connecting Westmoreland and Blaine, Kan. C. E. Simmons is Ch. Engr., Westmoreland.

MARSHALL & EAST TEXAS.—Incorporated in Texas by the purchasers of the Texas Southern Ry. The new company will

absorb the old line, which is to be improved and extended to the Gulf of Mexico. Capital, $75,000. The main line is now 74 miles long, from Marshall to Winnsboro, Tex. It has altogether about 110 miles of track. The incorporators of the new company are Osce Goodwin, J. F. Strickland, M. B. Templeton, J. W. Ogburn and J. J. Carter, of Dallas, Tex.; Albert T. Perkins, John F. Shepley and N. A. McMillan, of St. Louis, Mo.; E. Key, of Marshall, Tex., and C. H. Morris, of Winnsboro, Tex.

NAPA & LAKEPORT.—This company has been incorporated in California with capital of $2,000,000. The incorporators of the road are C. W. Coulisk, Merchant's Exchange Bldg., San Francisco; W. M. Ranke, Alameda, Cal.; and R. A. Morton. The route of the new road lies between Napa by the most direct and feasible line into Lakeport, on the shores of Clear Lake. Steam or electricity will be the motive power. It will be about 90 miles long.

PELHAM & HAVANA.—Grading has been commenced on the proposed line from Cairo, Ga., to Havana, Fla., 28 miles. Z. R. Hutcheson is Engr., and W. W. Griffin is Pres., at Cairo, Ga.

QUEBEC CENTRAL.—This railway will be extended 15 miles, from Saint George, Beauce to St. Justice, Que. J. H. Walsh is Gen. Mgr., Sherbrooke, Que.

SEABOARD AIR LINE.—Contracts have been awarded as follows, with a total value of about $500,000, for proposed terminal improvements at Grassy Island, near Tampa, Fla.: BURWELL & HILLYER, of Jacksonville, Fla., for construction of three wharves and storage warehouses; C. W. HUNT CO., 45 Broadway, New York, for phosphate elevator; PHOENIX BRIDGE CO., Phoenixville, Pa., bridge, and V. M. JOHNS, Portsmouth, Va., approaches for same. W. L. Seddon, Ch. Engr., Portsmouth, Va.

TEXAS SOUTHERN.—The property of this railroad, recently purchased by O. Goodwin, J. F. Strickland, E. Key and the St. Louis Trust Co., has been turned over to them, and they will commence repairs on the line as soon as possible. The name of the road will be changed to Marshall & East Texas, charter being filed at Austin, Tex. See "Marshall & East Texas."

WESTERN CENTRAL.—Articles of incorporation of the Western Central R. R. Co. have been filed with the County Clerk of Phelps County, Neb., and the work of survey and securing the right-of-way has been begun. Capital, $250,000. Directors: T. E. Brady, Charles Stanton, J. G. Burlingham, E. Q. Carlson, and S. C. Nelson, all of Omaha, Neb.

ELECTRIC RAILWAYS.

BOSTON, MASS.—The merging of three companies of the Newton system of street railways in the Middlesex & Boston Street Railway Co., which is already one of them, is the aim of a petition filed last week with the Railroad Commissioners, James L. Richards, Pres. of the Middlesex & Boston, the Westboro & Hopkinton Street Railway and the Natick & Cochituate Street Railway asks for consolidation of the two last-named with the first.

BUFFALO, N. Y.—The Buffalo & Lake Erie Traction Co., 530 Brisbane Bldg., Buffalo, has awarded to PETER B. COLGAN, Dunkirk, N. Y., contract for excavating two miles of main line over private right-of-way, beginning near Roberts Road and extending to the town of Sheridan. J. C. Calisch is Gen. Mgr.

BINGHAMTON, N. Y.—The Binghamton Railway Co., G. Tracy Rogers, Pres., is preparing plans for its proposed line from Binghamton to Owego. The line is already in operation as far as Union, 46 miles, and will be extended to Owego as soon as the renewal of franchise is granted by the Village of Owego, and plans are completed. J. P. E. Clark is Gen. Mgr.

SYRACUSE, N. Y.—The Syracuse, Lake Shore & Northern R. R. Co., now operating between Syracuse and Baldwinsville, 22 miles, and having a 12-mile double track extension under way between Baldwinsville and Fulton, is having surveys made and preliminary plans prepared for a further extension of eleven miles, double track, from Fulton through to Oswego. T. H. Mather, 500 Onondaga County Bank Bldg., Syracuse, is Ch. Engr.; R. A. Dwyer, Jr., Auburn, N. Y., Mechanical Engr.-in-Charge of Equipment.

*PATERSON, N. J.—Bids are asked until Sept. 15 for the grading, masonry and bridging on Section 1, of the North Jersey Rapid Transit Co.'s railroad between Paterson and Suffern, N. Y. Plans and specifications may be seen at the offices of the company, Colt Bldg., Paterson, N. J. Noted fully last week.

WEST CHESTER, PA.—The West Chester, Uwchland & Pottstown St. Ry. Co. has awarded contract to CHARLES P. GOLDSTROHM, of Pittsburg, for building this erectric railway, which is to connect West Chester and Pottstown. The road is to be completed within two years. Construction work will be started Oct. 1. Officers: C. W. Talbot, Pres.; H. A. Fetters, Vice-Pres., and Horace A. Fetters, Treas. Headquarters, West Chester. Noted on Aug. 13.

MORGANTOWN, W. VA.—The Morgantown & Dunkard Valley Traction Co. has decided to build a line five miles long from Morgantown to Wadestown. Amri Martin is Supt. of Construction.

SALISBURY, N. C.—The Piedmont Elec. Ry. Co. has been granted an extension of a franchise to build an electric railway skirting Salisbury on the north and west. The work is to begin within six months. The same company, which is headed by T. H. Vanderford, T. J. Jerome, M. L. Jackson, of Salisbury, proposes to belt Spencer and East Spencer with an electric railway.

HUNTSVILLE, ALA.—Edward L. Pulley and associates have been given franchises by the City Council to construct and operate an electric railway on Madison St. or Oak Ave., Gallatin, Holmes and Church Sts., and establish and operate an electric light and power plant in the city.

MANSFIELD, OHIO. — The Massillon, Wooster & Mansfield Traction Co., which is building an electric railway from Mansfield to Massillon via Wooster, with branches to Ashland, Turkey Foot Lake and Barberton, will connect 18 cities and towns and will have 79 miles of track. It will be equipped to handle passengers, express and freight. The company has finished a considerable amount of grading, it is stated. Capital stock, $1,000,000. Headquarters: 1433 Williamson Bldg., Cleveland, Ohio. Officers: G. A. Bartholomew, Pres. and Genl Mgr., Cleveland; J. W. Buchanan, Vice-Pres., Smithville, Ohio; R. L. Guthman, Secy., Youngstown; H. G. Bye, Treas., Youngstown.

WYANDOTTE, MICH.—Henry A. Everett has applied to the City Council for a street railway franchise in Wyandotte.

NAUVOO, ILL.—It is announced that the Western Illinois Traction Co. will start construction work about March 1, 1909, on its standard-gage line which is to connect Nauvoo and East Fort Madison, a distance of eleven miles. The line will be equipped with gasoline motor cars. Capital stock will be $100,000. The company has not yet been incorporated. R. Anton, Nauvoo, is Secy. and Treas.; J. A. Bortz, Mgr.

GREAT FALLS, MONT.—The surveyors for the Great Falls, Augusta & Chouteau Electric Ry. have completed the survey to Chouteau, the county seat of Teton County, and are now running a preliminary line over the Burton Bench. Noted last week.

KANSAS CITY, MO.—We are officially informed that THE ARNOLD COMPANY, 181 La Salle St., Chicago, has the contract for the electrification of the Missouri & Kansas Interurban Railway Co.'s line—about 19 miles long, extending from Kansas City to Olathe, Kan. This line has been in operation for a year or two, Strang gasoline-electric cars having been in service. Decision was recently made to electrify the line. The work contemplated in the immediate future consists of construction of pole line and overhead trolley, power plant, storage battery substation, together with the purchase of new interurban cars for the operation of the road. Contracts for the entire equipment have already been let, and construction work has been started. It is probable that the road will be completed and in operation the latter part of November. The work of electrification of the line, covering the items above enumerated, is being handled by the Arnold Company, who have a contract covering the design and construction of the entire installation.

AVA, MO.—We are officially informed that the Kansas City, Ozarks & Southern Elec. Ry. Co. is building its line with its own forces. The company was incorporated in Missouri to build and operate a standard gage electric railway between Mansfield, Wright County, and Ava, Douglas County, a distance of 16 miles. Capital stock, $300,000. The following officers have been elected: Pres., Albert Parker, Ava, Mo.; Vice-Pres., J. S. McIntosh; Secy., George W. Wilhelm, all of Kansas City, Mo.; J. B. Quigley, of Mansfield, Mo., is Ch. Engr. and Gen. Mgr., and C. H. O'Neill, of Topeka, Kan., Purchasing Agent. The surveys of the line between Ava and Mansfield have been completed and right-of-way and capital obtained. Noted on July 30.

OKLAHOMA CITY, OKLA.—We are officially advised that the Canadian Valley Ry. Co., which proposes to build a 150-mile interurban line connecting Fort Supply, Woodward, Mutual, Seiling, Canton, Geary, El Reno and Oklahoma City, has not decided upon date for commencing construction work. Company was incorporated with a capital stock of $2,000,000, as noted on April 30. Thomas Martin, Pres.; E. O. McCann, Secy.; L. A. Foster, Treas., Mutual, Okla.

CLATSKANIE, ORE.—We are officially advised that the Clatskanie & Nehalem Valley Elec. Ry. Co. will let construction contracts within the next 60 days. The line will extend from Clatskanie through the Nehalem Valley for a distance of about 30 miles. Surveys are being completed. Right-of-way is secured. There will be a 4,000-ft. tunnel. A. B. Kurtz is Pres., Clatskanie, Ore.; J. H. Abbott, Portland, is Ch. Engr. Noted on July 30.

ALBANY, ORE.—E. H. Rhodes, of Albany, is interested in project to build an electric railway from Albany to Brownsville, 22 miles, also a local street railway line.

TORONTO, ONT.—The Interurban Electric Co. has been incorporated here with a capital of $200,000. The incorporators are: H. S. Edminson, Ouhawa, Ont.; Fred. Grundy, A. N. Morine, C. H. Porter, M. McDonald, G. D. Lewis, Margaret D. Gray, Ethel Greenway, all of Toronto, Ont., and G. T. Turnbull of Seaforth, Ont. The charter granted is of the "blanket" variety and among the privileges granted the company are the rights to develop electricity and construct and operate electric car lines.

VANCOUVER, B. C.—At a recent meeting of the directors of the British Columbia Electric St. R. R. Co., held in London, England, the sum of $4,280,000 was voted for development work. Of this amount $200,000 will be spent on new offices while the balance will go for extensions to the system and improvements to the existing lines. R. H. Sperling, Gen. Mgr.

*PANAMA.—Bids are asked by the General Purchasing Officer, Isthmian Canal Commission, Washington, D. C., until 10.30 a. m., Sept. 28, for electric industrial railway, consisting of 15,600 ft. of trackage, with twelve electric locomotives and 24 flat cars.

List of bids received on Aug. 31 for an electric or cable railway, etc., is given under U. S. Possessions in this issue.

LIGHT AND POWER PLANTS.

(denotes that this work is advertised in Engineering News.)*

ANDOVER, MASS.—The Lawrence Gas Co., Lawrence, Mass., contemplates installing an electric lighting system in Andover. N. H. Emmons is Pres.

MEDFORD, MASS.—Contract has been awarded to LYNCH & WOODWARD, 26 Beach St., Boston, Mass., for additions and alterations to the power plant at the Asylum for The Chronic Insane. Ira G. Hersey is Chn. Bd. of Trustees.

HUDSON, N. Y.—The Albany & Hudson R. R. Co., Hudson, is planning improvements, including the purchase of a 2,000-HP. steam turbine, a 500-KW. motor-generator set and the erection of a new boiler house.

ELLIS ISLAND (New York post-office), N. Y.—The Secretary of Commerce and Labor, Washington, D. C., has the following contracts for the hospital improvements on Ellis Island: Heating and power work, EVANS, ALMIRALL & CO., 128 Water St., New York, $42,427; plumbing, C. F. MENTZINGER'S SONS, $28,515; switchboard and feeders, COMMERCIAL CONSTRUCTION CO., 114 East 28th St., $16,800, and electric lighting, COMMERCIAL CONSTRUCTION Co., $5,500.

BINGHAMTON, N. Y.—The Binghamton Railway Co. will build an extension at once to its transmission lines to enable it to furnish power for lighting the towns of Westover and Hooper and the western section of the Village of Lestershire, N. Y. J. P. E. Clark is Gen. Mgr.

ONEIDA, N. Y.—The Madison County Gas & Electric Co. will build a 60,000-volt transmission line at once from its steam plant in Oneida to Oneida Castle. The company will overhaul its present overhead system and change from a 60-cycle to a 40-cycle system. An additional generator will be installed at the Oneida plant with switchboard and accessories. E. J. Kenny is Mgr. and Supt.

FISHKILL LANDING, N. Y.—Van Houten Bros. will build a power plant on Academy St. to supply commercial power to a number of manufacturing plants, the first of which will be the Duchess Tool Co.

ALBANY, N. Y.—The Delaware & Hudson Co. is arranging to install an electric generating plant to serve its office building at North Pearl and Steuben Sts. The plant probably will be installed in duplicate and consist of either high speed engines direct connected to generators or steam turbine units.

AUBURN, N. Y.—The Auburn Light, Heat & Power Co. is arranging to double the capacity of its North St. power plant. A triple set of boilers of large capacity will be installed in place of those at present in use. M. C. Turpin is Mgr.

ASBURY PARK, N. J.—Bids will be received by the Common Council until Sept. 14 for the privilege of a franchise for a municipal and commercial lighting and furnishing electricity for heating and motors within the city limts of Asbury Park. W. C. Burroughs s City Clerk.

WASHINGTON, D. C.—Bids were received as follows on Aug. 31, at the office of Bernard R. Green, Const. Officer of the National Museum Building, Washington, for electric wiring in the rotunda: National Electric Supply Co., 1330 New York Ave., Washington, $12,262; Arthur Frantzen Co., Law Bldg., Baltimore, $12,571; Coburn & Cooke, Newport News, Va., $10,494; J. F. Buchanan & Co., 36 North Fourth St., Philadelphia, $15,400; Lord Electric Co., 213 West 40th St., New York, $11,837.

AUGUSTA SPRINGS, VA.—The Augusta Springs Tanning Co. has awarded the contract for wiring and installing an electric light plant in its tannery to SNYDER & SHEETS, of Staunton, Va.

EMPORIA, VA.—The Greensville Light & Water Power Corporation, of Emporia, Va., is preparing to expend $100,000 in the development of the water power of Meherrin River, one mile from Emporia. Engineers have made the necessary surveys and have decided that a minimum horsepower of 1,400 can be developed by erecting a 36-ft. dam across the river at the Watkins old mill site, one mile west of Emporia. W. S. Goodwin, Emporia, is Pres.

WHEELING, W. VA.—We are officially advised that the following bids were received on Aug. 26 by Capt. F. W. Altstaetter, Corps of Engrs., U. S. A., for building a power house at each of Dams Nos. 18, 19, and 26: Joseph Hile, John S. Higgs, Parkersburg, W. Va., (18) $24,207, (19) $24,287, (26) $24,587. John C. Unkefer & Co., Minerva, Ohio, (18) $32,879, (19) $32,879, (26) $34,038. Volney & Taylor, Central City, W. Va., (18) $36,396, (19) $36,396, (26) $36,396. C. L. Mohney & Co., Pittsburg, Pa., (18) $35,653, (19) $32,943, (26) $32,100. W. Rateson & Co., Wheeling, W. Va., (18) $38,488, (19) $41,613, (26) $39,257.

TYBEE (Fort Screven post-office), GA.—The Town Council is considering the question of installing a municipal electric light plant, and will take steps to secure estimates of the cost of the same. Robert P. Lovell is Mayor.

BARNESVILLE, GA.—The City Council has let contract for the improvement of the electric light and water plants, amounting to $7,000, and work will commence at once on them. The contracts were let to the ALLIS-CHALMERS CO., and FORT WAYNE ELECTRIC CO.

GURLEY, ALA.—F. A. Howe, Jr., Huntsville, Ala., will establish at Gurley an electric plant, capacity to be 200 lights and probably increased in future to 500 lights. Gasoline engine and 220-volt direct-current engine will be used.

HATTIESBURG, MISS.—It is proposed to harness Boule River at its confluence with Leaf River, above the city, and to erect there a water-power plant capable of supplying the city with lights and power for all purposes. A report has been made by a Government expert who recently visited the proposed site on its possibilities by the Hattiesburg Traction Co., which [illegible] ent lighting system and is p[illegible] the proposed bonds for the equipment of [illegible] way, the rails for which have [illegible] is probable that definite steps [illegible] in a few days to organize [illegible] company and that many of the [illegible] ness men of the city will be [illegible] possibilities of securing che[illegible] manufacturing companies are [illegible] the Commercial Club has exp[illegible] mination to take hold of the [illegible] earnest. It is said that Boule[illegible] point mentioned is capable of [illegible] 000,000-HP., which would be [illegible] all reasonable future needs.

CLARKSDALE, MISS.—We [illegible] advised that contracts were awa[illegible] on Aug. 25 to THE WEBER CO., Memphis, Tenn., for concrete-steel chimney; to [illegible] GINE CO., Erie, Pa., for 240-HP. engine; and to CROCKER-WHEELER [illegible] for 300-KW. generator. Contracts for [illegible] ervoir, repairs to the building a[illegible] piping have not been awarded. [illegible] Kirkpatrick, Jackson, Miss., is Engr.

PORTSMOUTH, OHIO.—Bids will be received by the Board of Public Service until Sept. 24 for lighting the streets and public places of the city with electricity or other illuminants for a period of three, six or ten years, in accordance with plans and specifications approved by the City Council. George H. Schneider is Pres. of the Bd.

FREMONT, OHIO.—The Fremont Power & Light Co., which was recently granted a franchise by the City Council, has accepted the terms of the franchise and announces that work on the construction of the new plant will begin at once. The company proposes to develop water power in the Sandusky River, and will erect a large power plant in Bayville, south of Fremont.

BUCYRUS, OHIO.—At a meeting of the Board of Public Service held on Aug. 19, the lighting bid of the Bucyrus Electric Light & Gas Co. was rejected and the city decided to build a municipal plant to cost $90,000.

XENIA, OHIO.—Bids are asked until noon, Sept. 19, by the Board of Trustees of the Ohio Soldiers' and Sailors' Orphans' Home, at Xenia, Ohio, for furnishing the materials and performing the labor necessary to build the power plant and remodel the present system of light and water at the Ohio Soldiers' and Sailors' Orphans' Home, at Xenia. Col. John C. Roland is Secy. Bd.

LOGANSPORT, IND.—Plans and specifications for a municipal electric light plant have been submitted to the Board of Public Works by Prof. J. Walter Esterline, of Purdue University. The plans provide for the installation of a 500-KW. 60-cycle turbo generator and also a 150-KW. generator, which will be belted to a Buckeye engine. The city arc lights are to be changed and a smokestack is to be erected. More water power is to be used than heretofore and, according to plans, there will be an annual saving of $9,000 in coal and $960 in arc light bills, besides an increase in power from 600 to 700 KW. The City Council has appropriated $38,000, the estimated cost of the plant, and Prof. Esterline has been engaged to supervise the purchase and installation of the new equipment. Noted last week.

MORGANTOWN, IND.—The Morgantown Light & Power Co., recently incorporated, will construct and equip a plant. William T. Gipson, Jesse H. Deer and W. W. Davis are Dirs.

CRAWFORDSVILLE, IND.—The Pleasant Shades Power Co. has been incorporated for the purpose of constructing dams and reservoirs for power and light purposes. Henry Vancleave and M. M. and I. E. Ewers, are Dirs.

DETROIT, MICH.—The Public Lighting Commission has awarded a contract to the WESTINGHOUSE ELECTRIC & MFG. CO., Pittsburg, Pa., for a turbo-generator set, similar to the one now in use at the municipal electric light plant, to cost $53,000. The Commission is considering the question of installing flaming arc lamps on Woodward Ave. from the river to Grand Circus Park.

DODGEVILLE, WIS.—The Dodgeville Electric Light & Power Co. has been granted permission to erect an electric plant on the railroad land south of the Illinois Central passenger depot. The company will erect a building. It is expected that an ice and heating plant will be operated in connection with the plant. The city will take possession of its buildings and boilers used by the Dodgeville Electric Light & Power Co., the ten years' franchise held by the company having expired.

KEWAUNEE, WIS.—We are officially advised that bids were received by W. Wiesner, City Clerk, on Aug. 27, and contract was let to the LANGSTADT MEYER CONSTRUCTION & SUPPLY CO. for the construction of an electric light plant, the work to include the construction of a brick building, pole line and wiring; one 50-KW., 2-phase, alternating-current dynamo, arc light equipment, and an 85-HP. high speed compound condensing steam plant. Oscar Claussen, German-American Bank Bldg., St. Paul, Minn., is Consult. Engr.

KAUKAUNA, WIS.—Work will commence immediately on the construction of a dam across the Fox River for the Green Bay and Mississippi Canal Co. The dam will be nearly 3,500 ft. in length with a 28-ft. head and will develop 3,000 HP. The power house is nearly completed, and it is expected to put the plant in operation about Sept. 15, when all of the mills on the upper power will be operated by electricity instead of water power, except those on the Mead and Edwards Canal and the Outagamie Paper Co.

GREAT FALLS, MONT.—We are advised that the Great Falls Water Power & Townsite Co. will commence work immediately on a dam across the Missouri River at the

Rainbow Falls, two miles below the city. This dam will develop 25,000 HP. John D. Ryan is interested.

LITTLE ROCK, ARK.—The Little Rock Railway & Electric Co. has awarded contract to the WESTERN ELECTRIC CO. for a 1,500-KW. turbine. The company is engaged in enlarging the water-purifying plant at the power station. A new coal storage plant is also under way. It is stated that the amount to be expended at the power station reaches $130,000 or more.

SHERMAN, TEX.—We are officially advised that contract will be let in September or October for installing electric light and water systems in this town. Estimated cost, $30,000. C. E. Craycroft is Mayor and Chn. Water and Light Com.; P. C. Thurmond is City Engr.

MARSHALL, TEX.—Press reports state that King & Johnson, of Dallas, Tex., have purchased the franchise to furnish Marshall, Tex., with natural gas and that they will construct a pipe line from the Caddo Parish, La., gas field to this city, a distance of ap- proximately 30 miles. Several gas wells in the Caddo Field are estimated to produce from 40,000,000 to 50,000,000 cu. ft. a day each.

DENVER, COLO.—At a recent meeting of the stockholders of the Southern Colorado Power Co., a bond issue of $1,500,000 was authorized for the purpose of enlarging, improving and extending the power plants, railway lines, and light systems of the company. It is believed by the officers of the company that they may be able to close contracts with the Colorado Fuel & Iron Co. to furnish electric power for operating its coal mines around Sopris, Starkville, Berwind, and the other camps of the Trinidad District. At the election of officers, which was held at the same meeting which authorized the bond issue, the following men were selected: J. J. Henry, Pres.; J. C. Schupler, Vice-Pres.; L. C. Duncan, Secy. and Treas.; and D. H. Rupp, Asst. Secy.

SEATTLE, WASH.—According to the estimate furnished by L. B. Young, Supt. of the Light and Water Dept., over $500,000 will be required to finish the construction and extension of the municipal lighting plant. Bonds will be issued secured by the revenues from the lighting plant to raise the money. There has been issued $1,440,000 of lighting bonds and with the amount proposed to be issued the total capitalization of the plant will be about $2,000,000.

ASHLAND, ORE.—Frank C. Kelsey, 415 Corbett Bldg., Portland, Ore., is preparing plans for a power plant to be constructed by the City of Ashland, on Ashland Creek Canyon, to cost about $60,000. M. F. Eggleston is City Recdr.

EUREKA, CAL.—Capt. Walter Coggeshall, of the Coggeshall Launch Co., has been making plans for an amusement park to be built on Humboldt Bay. A gasoline power plant will be installed to supply current for electric illumination and it is expected the total costs will amount to between $5,000 and $6,000.

BISHOP, CAL.—A fourth plant of 8,000 HP. is to be erected soon by the Nevada-California Power Co., of Tonopah, Nev., at Bishop Creek, Cal. These plants will then use the water of the creek at three times. The first plant is 8,000 HP., the second 2,000, the third, now under construction, 8,000. This will make a total of 26,000 HP. to supply the mines and other plants of southern Nevada. C. O. Poole, Asst. Mgr., states that work on the new plant will start as soon as the present one is completed. Manhattan and Round Mountain are to be connected with the long distance wire, which work will be accomplished by spring. Tonopah and Goldfield are increasing their demands for both light and power. D. A. Chappell is Mgr., Denver, Colo.

FRESNO, CAL.—We are officially advised that bids will be called for in about one month by Mickey Ryan, City Clerk, for an electrollier light system for the streets. George L. Hoxie is City Engr. Cost, $50,000.

WILKENBURG, ARIZ.—The Octave Mining Co. has purchased three acres of the Henry Wickenburg homestead in Wickenburg for a site for the plant and its appurtenances. A transmission line from Wickenburg to the Octave camp through the Weaver District will be built. Machinery for additional power will be added to the plant now in contemplation when the latter is built, provided there is a demand for it by the mining concerns operating in the southern part of Maricopa County.

WINGHAM, ONT.—The Town Council is reported to have awarded contract for new machinery for the electric light plant to the CANADIAN GENERAL ELECTRIC CO., of Toronto, at $4,350.

BRIDGES.

(denotes that this work is advertised in Engineering News.)*

BOSTON, MASS.—Bids are asked by William Jackson, City Engr., until Sept. 10, for rebuilding the Massachusetts Ave. bridge. Although the Boylston St. bridge, which has been closed for repairs, will be reopened for traffic this week, the temporary street car tracks on Hereford and Newbury Sts., will be retained pending the completion of the work on the Massachusetts Ave. bridge.

WATERFORD, N. Y.—The following bids were received by F. C. Stevens, Supt. of Public Works, on Aug. 27, for construction of plate girder bridge over the Champlain Canal at Mohawk St., Waterford, N. Y.: M. Fitzgerald, Hoosick Falls, N. Y., $20,016; John W. Flynn, Waterford, N. Y., $16,105. The contract was awarded to JOHN W. FLYNN for $16,105. Itemized bids for this work are given in this issue under Contract Prices.

RINGOES, N. J.—Bids will be received until Sept. 5 by the Board of Chosen Freeholders at Salter's Hotel at Ringoes, for constructing a low truss, riveted, connected wrought-iron or steel bridge over a branch of the Neshanic River on the road from Ringoes to Wertsville. The span of the bridge is to be 54 ft. 10 in. and the roadway 14 ft. Capacity to sustain a 12-ton roller. Bids are to include the removal of the present wooden bridge. John W. Sharp is Dir.

MONTCLAIR, N. J.—On Aug. 26 the Board of Freeholders of Sussex County awarded a contract to the CANTON BRIDGE CO, of Albany, N. Y., to build a bridge over the River Styx, in Bryan Township. The cost of the bridge will be $10,285. The bridge will be 594 ft. long, and the middle span of 100 ft. will be ten ft. above the high water mark, instead of seven ft. as in the original plan.

WILKES-BARRE, PA.—Bids are asked until 2 p. m., Sept. 10, by the County Controller, for constructing a steel girder bridge near Prospect Breaker, on the main road leading from Wilkes-Barre to Pittston. Harry Meyers is Engr., Pittston.

SOMERSET, PA.—Bids are asked until 10 a. m., Sept. 16, by the Commissioners for constructing one reinforced concrete arch, or reinforced concrete floored steel bridge and abutments for same bridge over Brush Creek, in Northampton Township, with 30 ft. span and 16-ft. roadway.

PHILADELPHIA, PA.—Proposals for the construction of an intercounty bridge over Cobb's Creek on the line of Woodland Ave. were received on Aug. 28, and the contract for the work to be completed in nine months, was awarded to the AMERICAN PAVING & CONTRUCTION CO., 211 South Ninth St., for $19,300. The Miliard Co. offered to build the bridge in four months for $20,920. The cost of the structure will be divided equally between this city and Delaware County.

OAKMONT, PA.—The contract for constructing a bridge to be erected by Allegheny County has been awarded to the AMERICAN BRIDGE CO., 30 Church St., New York, for $269,371. The structure will span the Allegheny River at Oakmont connecting that borough with Harmar Township. It is expected that the work will be completed by June 1 1910. Following are the bids received on Aug. 26: American Bridge Co., $269,371; Pennsylvania Steel Co., $315,168; Penn Bridge Co., $314,638; McClintic-Marshall Construction Co., $292,001; Fort Pitt Bridge Co., $320,817; King Bridge Co., $269,873. The structure will have five steel spans with a total length of 1,543 ft. Its height will be 50 ft. above "pool full" when Dam No. 2 is completed a month hence, with from ten to twelve feet of slack water.

*WASHINGTON, D. C.—Bids are asked until 11 a. m., Oct. 8, by R. C. Holiyday, Ch. of Bureau of Yards and Docks, Washington, for constructing a single-leaf railway rolling lift bridge, at the U. S. Navy Yard, Washington, D. C. Specifications are on file at the office of Engineering News, New York.

*ATLANTA, GA. — We are officially advised that H. B. THOMPSON, Birmingham, Ala., has secured contract, at $12,302, for constructing a reinforced concrete viaduct on Ponce de Leon Ave., Druid Hills, Atlanta. D. Lee Wardroper is City Engr.

TAMPA, FLA.—The City Council has awarded contract to the EDWARDS CONSTRUCTION CO., of Tampa, for construction of approaches and piers for bridge to be erected across Hillsboro River from the foot of Garcia Ave. Estimated cost, $26,000.

TAMPA, FLA.—See Buildings.

CLEVELAND, OHIO.—The lowest bid received on Aug. 24 by the County Commissioners was submitted by Schillinger Bros. Co., 1181 North Seeley Ave., Chicago, Ill. at $208,299. The other bids were: New York Construction & Jewell Filtration Co., New York, $236,835; E. M. Graves, Cleveland, $244,654; Carey Construction Co., Cleveland, $247,331; Hunkin Brothers, Cleveland, $247,678; C. H. Fath & Son Construction Co., Cleveland, $249,829; Beers & Doolittle, Cleveland, $251,207; Westgate & Casey, Columbus, $252,981; M. Wardell, of Elyria, Ohio, 256,515.75; J. D. Tuttle, Cleveland, $261,655; Baltimore, Ferro Construction Co., Baltimore, $266,983.85; Ferro Concrete Construction Co., Cincinnati, $270,837.26.

LANCASTER, OHIO.—Bids are asked until 11.30 a.m., Sept. 12, by the Commissioners of Fairfield County, for steel superstructure of a bridge over the Hocking River, near the Deeds Mill in Berne Township, in said county, to consist of one span 63 ft. 3 ins. clear of abutments, with clear roadway of 13 ft. H. C. Belt is Clerk.

FRANKLIN, IND.—Bids are asked until 10 a. m., Sept. 7, by the Commissioners of Johnson County, for constructing a 96-ft. bridge and a 12-ft. bridge. W. B. Jennings is County Audr.

CROWN POINT, IND.—Bids will be received until Sept. 8 by the County Commissioners at Crown Point for constructing a concrete arch in Cedar Creek Township, also raising the Forsyth Ave. bridge over the Calumet River at East Chicago. Charles A. Johnson is County Audr.

INDIANAPOLIS, IND.—The Commissioners of Marion County will ask for bids soon for the construction of 13 bridges, the aggregated estimated cost being $300,000. John McGregor is Chn.

*ST. JOSEPH, MICH.—Bids were received on Aug. 12 by Harry L. Murphy, City Clk., for constructing a swing bridge and approaches over St. Joseph River at State St.; total length 780 ft. The contract for the superstructure was awarded to JOLIET BRIDGE & IRON CO., Joliet, Ill., and for the substructure to G. A. ALLMENDINGER, of Benton Harbor, Mich.

CHICAGO, ILL.—Bids will be received about Sept. 24 for constructing foundations of the Chicago & Northwestern R. R. bridge at Mayfair crossing on Shore Channel. Cost, about $40,000. G. M. Wisner, American Trust Bldg., is Ch. Engr., Sanitary District of Chicago.

LITTLE FALLS, MINN.—Bids are asked until 1 p. m., Sept. 29, by William A. Butler, County Audr., for construction of a bridge over Crow Wing River between Cass and Morrison Counties. Bidders are to furnish plans and specifications. Substructure of bridge is to be of concrete or of tubes filled with concrete.

INDEPENDENCE, KAN.—Bids will be received until Sept. 14 by the County Commissioners at Independence for constructing an iron bridge and 16 steel bridges in this county. E. H. Stewart is County Clerk.

MANHATTAN, KAN.—Bids are asked until noon, Sept. 8, by George H. Hungerford County Clerk, for constructing three bridges as follows: Steel bridge, three 75-ft. spans, 18-ft. roadway with reinforced concrete floor, a 1-span steel bridge 80 ft. long, 18 ft. roadway, and a 1-span 70 ft. long steel bridge.

GREAT FALLS, MONT.—Bids are asked by the County Commissioners until Sept. 15 for three steel bridges to be erected in this county. The bridges are located across Hound Creek, Smith River and a new span for the Sun River bridge.

MARLIN, TEX.—The Commissioners' Court on Aug. 19 let the contract for the construction of an iron bridge over the Brazos River at the Belton crossing. The proposition of the MORAYA CONSTRUCTION CO., 204 Dearborn St., Chicago, to furnish all material and complete the structure for the sum of $35,000 was accepted. The structure will consist of two spans of 300 ft. each, and has been designed to accommodate one line of electric railway. The total weight of the bridge will be: Metal, 671,000 lbs.; timber, 225,000 lbs. This bridge was designed by J. W. Maxey, of Houston. A condition in the contract is that the bridge be completed and ready for use by Jan. 15, 1909.

A contract to repair the High Bank bridge was let to the MISSOURI VALLEY BRIDGE CO. for $6,002. The repairs include two new spans. The former bridge at the Belton crossing was totally destroyed by the floods of May, and the one at High Bank was damaged by the same agency.

SAPULPA, OKLA.—Contracts for the erection of five steel bridges in Creek County have been awarded the TOLEDO-MASSILLON BRIDGE CO., Dorr St., Toledo, Ohio. The total cost is to be $11,714.

SPOKANE, WASH.—The City Council at its meeting on Aug. 12, approved and adopted plans prepared by J. C. Ralston, City Engr., for the construction of a reinforced concrete bridge across the Spokane River at Mission Ave. (to be erected by day labor) to have a 40-ft. roadway and a capacity of carrying 50-ton street cars. The estimated cost is $116,640, the work on same to proceed with all possible haste. All bids received by the Board of Public Works on Aug. 11 for the erection of this bridge by contract, were rejected.

OROVILLE, CAL.—Bids are asked until 2.30 p. m., Sept. 8, by H. T. Batchelder, Clerk Bd. Supervs. of Butte County, for making the fill for the approach at the east end of the bridge now being built by Glenn and Butte counties across the Sacramento River at the Gianella Site.

PASADENA, CAL.—Bids are asked until 2 p. m., Sept. 21, by County Supervisors, C. G. Keyes, Clerk, for constructing a bridge over the Arroyo Seco on Linda Vista St., Pasadena. The bridge will be about 600 ft. long and bids will be received for reinforced concrete or steel trestle bridge.

WILLOW, CAL.—Bids are asked by Supervisors of Glenn County, at the office of W. H. Sales, County Clerk, until 10 a. m., Sept. 10, for constructing a bridge across slough, in Road District No. 2, Supervisors' District No. 2 on the road leading from Hamilton City to the Gianella bridge on the Sacramento River.

BUILDINGS.

(denotes that this work is advertised in Engineering News.)*

PORTLAND, ME.—J. P. Baxter, of Portland, has awarded a contract to the ABERTHAW CONSTRUCTION CO., 8 Beacon St., Boston, Mass., for the erection of a 6-story store and office building in Congress St. This building is to be built of reinforced concrete. The columns, floors, stairs and foundations will be of this material.

PORTLAND, ME.—James Knox Taylor, Superv. Arch., Treasury Dept., Washington, D. C., has awarded contract for the construction of a post-office building at Portland, Me., to F. W. CUNNINGHAM & SONS, Portland, Me., at $179,920. A complete list of bids received on July 30 was given on Aug. 6.

NORTHAMPTON, MASS.—The contract for erecting the proposed library at Smith College has been awarded to CASPER RANGER, of Holyoke, Mass., and work will be started at once. The building will cost $125,000. Plans, prepared by Lord & Hewlett, Archs., 16 East 23d St., New York, show a structure of Colonial style 125 ft. in length and 65 ft. wide of two stories, constructed of brick with trimmings of brown stone and marble.

FORT STANDISH (Boston post-office), MASS.—Bids are asked by Capt. Ira L. Fredendall, Constr. Q. M., 263 Summer St., Boston, until 11 a. m., Sept. 24, for the construction, plumbing, hot air heating, electric wiring and fixtures for quarters for one N. C. officer at Fort Standish, Boston Harbor, Mass.

FALL RIVER, MASS.—Bids for the construction of a school on Lapham St., were received Aug. 24, by D. H. Shay, Supt. of Pub. Bldgs., and were as follows: General Contract—Alfred McQuillan, $54,835; John Crowe Co., $50,679; Arthur Puleston, $54,645; Beattie & Wilcox, $56,000; Patrick Corrigan, $51,641; Mitchell Nicholson, $51,638; William A. Borden, $51,808. Plumbing—William Kennedy, $3,600; John F. Johnston Co., $3,675; W. H. & J. F. Whalon, $3,750; Nathan Miller, $3,920. Heating —Fall River Steam & Gas Co., $4,985; W. H. & J. F. Whalon, $5,063; John F. Johnston Co., $5,077; Nathan Miller, $5,323; Henri Legasse, $5,500.

NEW BEDFORD, MASS.—The following are the bids received by the County Commissioners for erecting a registry of deeds building in New Bedford. General construction, Herbert A. Miller, New Bedford, $122,500; Charles O. Brightman, New Bedford, $119,000; Beattie & Wilcox, Fall River, $90,739; D. Herbert Cook, New Bedford, $90,316; Henry T. Bulman, New Bedford, $97,250; John B. Sullivan & Son, New Bedford, $91,777; Charles B. Maguire & Co., Providence, R. I., $89,518. Heating and ventilating: John Perra, $6,120; Isaac Coffin, Boston, $5,365; John F. Johnston & Co., Fall River, $5,343.

EAST PROVIDENCE, R. I.—The plans of Banning & Thornton, 87 Weybossett St., Providence, have been accepted for the high school to be erected in East Providence at a cost of about $65,000.

HARTFORD, CONN.—Bids are asked until Sept. 8 by the State Library and Supreme Court Building Commission, Hon. Morgan G. Bulkeley, of Hartford, Chn., and L. W. Robinson, New Haven, Secy., for construction of proposed marble or granite library building at Hartford. The Commission has accepted the plans of Donn Barber, 24 East 23d St., New York, and E. T. Hapgood, Hartford, Associate Archs., for the proposed building, which is to cost approximately $1,000,000.

NEW YORK, N. Y.—Bids are asked until 2.30 p. m., Sept. 14, by Robert W. Hebberd, Comr. of Public Charities, for furnishing all the labor and materials required for the entire completion of a new waiting room situated on the dock at the foot of East 53d St., Boro. of Manhattan, the City of New York.

Bids are asked until 10 a. m., Sept. 15, by the Board of Health, Dr. Thomas Darlington, Pres., for furnishing all the labor and materials necessary or required to erect and complete an addition to the stable of the disinfection and ambulance station on the grounds of the County Poorhouse Farm, Boro. of Richmond, City of New York.

NEW YORK, N. Y.—Bids are asked by Nicholas J. Hayes, Fire Comr., until 10.30 a. m., Sept. 14, for furnishing all the labor and materials required for the erection and completion of a building for Engine Company 64, on the easterly side of Ave. C, 60 ft. south of Ellis Ave., the Bronx.

We are officially advised that J. W. BISHOP CO., 345 Fifth Ave., New York, has been awarded contract for making over the 4-story and basement dwelling at 618 Fifth Ave. The ground floor is to be used as a branch of the Equitable Trust Co., of 15 Nassau St. The floors above are to be remodeled into bachelor apartments. The cost is estimated at $60,000. Heins & La Farge and A. C. Jackson, 30 East 21st St., are Archs.

NEW YORK, N. Y.—Bids are asked by John W. Brannan, Pres. Bd. of Trustees Bellevue and Allied Hospitals, until 3 p. m., Sept. 9, for providing all labor and materials required for the tearing down and removal, excavation, masonry, dampproofing, repairing and replacing of machinery and all other work required to render sound and perfect the dampproofing of elevator pits, and damaged elevator machinery at Fordham Hospital, Crotona Ave. and the Southern Boulevard, the City of New York.

Plans for the main hospital building and isolation annex of the Rockefeller Institute for Medical Research, on East 65th St., east of Ave. A, and extending to the East River, have been filed by York & Sawyer, Archs., 156 Fifth Ave. The main building will have seven stories, with a brick and Indiana limestone front. The isolation wards will be in a 2-story building connected with the main building by steel bridges. It is estimated the cost of the hospital buildings will be $350,000, the isolation annex $50,000 and the power-house $5,000.

Plans have been filed for a church edifice and parish house to be erected on Washington Heights at the corner of Fort Washington Ave. and 178th St., for the Chelsea Methodist Episcopal Church, at present in West 30th St. The building will be of Gothic design, with an avenue frontage of 85 ft., finished with two battlemented towers 76½ and 68 ft. high, respectively, crowned with decorative pinnacles. The facades will be of granite and terra cotta, and the local stone of the Heights. The church will be a basement and 2-story building and will have a central entrance with triple entrance doors. In the rear will be a 3-story and basement parish house, 44 ft. deep. The buildings are to cost $110,000. Bannister & Schell, 69 Wall St., are Archs.

OGDENSBURG, N. Y.—Bids are asked until noon, Sept. 10 by George Hall, Ogdensburg, for erecting an academy building here for the Board of Education. Wilson Potter, 3 Union Sq., New York, is Arch.

CORNING, N. Y.—The Board of Education will erect a 2-story brick graded school building on Fifth St. in the fall.

SCHENECTADY, N. Y.—The Board of Contract and Supply of this city has called for bids for the construction of an 8-room school building on South Center St. Harry F. Miller is Secy. of the Bd.

*FORT HANCOCK, N. J.—Plans and specifications for constructing one set of N. C. O. quarters and two sets of firemen's quarters at this post are on file at the office of Engineering News, New York. Bids are asked until Sept. 27.

PITTSBURG, PA.—The First National Bank proposes to build a 5-story bank and office building on the site of its present building at Fifth Ave. and Wood St. Foundations, etc., will be built with a view of erecting a 25-story building, eventually. The building will be 120 × 80 ft.

Plans have been accepted for the proposed St. Joseph's Hospital, on the Southside, which is to be built on the site of the present institution on Carson St., between South 21st and 22d Sts. The cost of the new structure will be $100,000, and it will occupy 66 × 120 ft. of ground. The building has been designed by John T. Comes, Arch., Washington Bank Bldg. It will be five stories high. The capacity of the hospital will be 100 beds. The building will face on Carson St. There will be two driveways, one for the use of the ambulance and the other for supply wagons. The building will be fireproof.

PHILADELPHIA, PA.—Bids are asked until 10.30 a. m., Sept. 8, by the Committee on Property of the Board of Education, for the erection of the William Penn High School for Girls, to be erected on the west side of 15th St., between Wallace and Mt. Vernon Sts. It will be brick, with granite base and sandstone and terra cotta trimmings. It will face 200 ft on 15th St., 228 ft. on Wallace St., and 224 ft. on Mount Vernon St., and will cost $565,000. William Dick is Secy.

PHILADELPHIA, PA.—Following are the lowest bids received on Aug. 19 by the Director of Public Works for erecting police and fire stations in various parts of the city: Police station on Willow Grove Ave., John R. Wiggins, $56,900; police station, 19th and Oxford Sts., Lynch Bros., $60,-864; police station, Woodland Ave. and Market St., John R. Wiggins, $52,950; police station, 20th and Buttonwood Sts., E. F. Fonder Co., $55,000; fire station, 229 South 8 xth St., Henry E. Baton, $28,354.

BALTIMORE, MD.—A permit to erect the $215,000 Masonic Temple has been issued from the Building Inspector's office. The building was designed by Joseph Evans Sperry, Arch., Calvert Bldg., Baltimore, and the contracts have been awarded to JOHN HILTZ & SONS CO., 3 Clay St. The structure will consist of marble, brick and steel. It will be four stories high, and have a frontage of 92 ft., with a depth of 140 ft.

The Church Extension Society of Methodist Episcopal Church has purchased a site 75 × 160 ft. at the corner of St. Paul and 33d Sts. and will erect a $100,000 church. Rev. Charles W. Baldwin, 1408 Bolton St., can be addressed.

RICHMOND, VA.—We are officially advised that the city will erect a combined market and armory. It has not been decided when bids for the work will be asked. Cost, $100,-000. Carlton McCarthy is Mayor; Charles E. Bailing is City Engr.

CHARLESTON, S. C.—The following bids were received on Aug. 22 by H. A. M. Smith, Chn. Bldg. Com. of the Pub. School Comrs., for erecting the Julian Mitchell School on Shepard St. Bids submitted for the general construction were as follows: King Lumber Co., of Charlottesville, Va., $40,950; H. T. Zacharias, of Charleston, $38,678; Nicholas Ittner, of Atlanta, Ga., $37,681; G. A. Clayton, of Atlanta, Ga., $36,875; Johnson & Mathews, of Florence, Ala., $36,504; J. T. Snelson, of Charleston, $35,000; SIMONS-MAYRANT CO., of Charleston, $34,688 (awarded contract). R. M. MASTERS, of Charleston has secured the contract for the heating, at $2,695, and for the plumbing at $1,349.

TAMPA, FLA.—The Seaboard Air Line Ry. Co. has awarded contracts for its terminal facilities to be built at Grassy Island, Tampa, Fla. The contract for three wharves with a total length of 2,400 ft. and for a storage warehouse 75 × 400 ft. has been let to BURWELL & HEALYER, of Jacksonville, Fla. The C. W. HUNT CO., 45 Broadway, New York, N. Y., has been awarded the contract for a phosphate elevator with a capacity of 300 tons per hour. The PHOENIX BRIDGE CO., of Phoenixville, Pa., contract for a steel-lift bridge with a span of 187 ft., and V. M. JOHNS, of Portsmouth, Va., secured the contract to build the approaches to the bridge. A contract was previously awarded to the ATLANTIC, GULF & PACIFIC DREDGING CO. to dredge the channel to the wharves, this work making a total of 350,000 cu. yds. The total cost of the terminal work will be about $500,000. W. L. Seddon, Portsmouth, Va., is Ch. Engr.

HATTIESBURG, MISS.—The New Orleans & Northeastern R. R. Co. is reported as having ordered the GRAHAM CONSTRUCTION CO., of Hattiesburg, to begin grading foundation for proposed passenger depot, 40 × 300 ft., ordinary brick construction, with tile roof, steam heat, gas and electric fixtures. Estimated cost, $125,000. Frank P. Milburn & Co., Home Life Bldg., Washington, D. C., are Archs.; James C. Haugh, New Orleans, La., is Engr. for railway company.

MEMPHIS, TENN.—Plans for a warehouse have been ordered by Orgill Bros., and are being prepared The cost of the structure has not as yet been estimated, but it will be over $100,000. The warehouse will be built of brick, mill construction being used throughout. It will be fireproof, and the floors will be of reinforced concrete. It will be erected on the site of the old warehouse, Tennessee St. and Calhoun Ave., which was destroyed by fire recently.

RICHMOND, KY.—Bids are asked until Sept. 10 by C. C. & E. A. Weber, Archs., First National Bank Bldg., Cincinnati, for a 2-story school building, 3-story girls' dormitory, and a 3-story addition to boys' dormitory, for the Eastern Kentucky State Normal School, Richmond. Cost, $100,000.

FRANKFORT, KY.—It is reported that the State Board of Charitable Institutions has accepted the plans of D. X. Murphy & Bro., 250 Fifth St., Louisville, for the girls' dormitory and laundry to be erected at the Feeble Minded Institute at Frankfort, and that bids for the erection will be received by Albert Scott, Chn. of the Bd., at Frankfort, until about Sept. 8. Cost, $65,000.

CLEVELAND, OHIO.—A 4-story brick building is to be erected on the corner of West 25th St. and Clark Ave., S. W., to be called the Frank L. Thompson block. It is being built by Mrs. Nellie T. Crane, on her father's estate. A frame building will be removed to make way for the structure. The building, which is being designed by Frederick F. Book, Arch., will have a frontage of 104 ft. on Clark Ave. and 66 ft. on West 25th St. The first story will be for stores, the second for offices, the third for a West Side business college and the top for a lodge-room. The material to be used will be brick, the building being semi-fireproof. It will cost about $50,000.

Bids are asked by Charles Orr, Dir. of Schools, Bd. of Education, East Sixth St., until noon, Sept. 21, for work necessary to complete the school building on the property owned by the Board of Education on Columbia Ave., N. E., and to be known as Columbia School.

COLUMBUS, OHIO.—Lieut.-Col. C. H. Murray, Commandant at the Columbus Barracks, has been notified that plans contemplating the erection of several new buildings here, at a cost of from $85,000 to $125,000, are being prepared at Washington. It is expected that work on these buildings will commence soon and that the buildings will be completed within a year. Two new barracks will be erected with accommodations for 300 men each, and will cost from $50,000 to $80,000. One of the old buildings will be converted into a laundry at a probable cost of $10,000. A new building for the fire apparatus will cost about $2,000, and it is estimated that it will take $20,000 to remodel the present dining room so that it will accommodate 2,000 instead of 1,000 men. The large barracks in the center of the grounds is to be remodeled at a cost of $10,000.

MUNCIE, IND.—We are officially advised that Cuno Kibele, Arch., is preparing plans for a 3-story city hall, 110 × 125 ft. L. Guthrie is Mayor. Cost, $110,000.

INDIANAPOLIS, IND.—Bids are asked by the Board of Works until Sept. 4 for furnishing and installing an additional turbine pump and other apparatus at the City Hospital. The specifications call for a quantity of electrical apparatus.

WINONA LAKE, IND.—The Methodist Building Association has acquired a site upon which to erect a $50,000 hotel. Dr. W. J. Vigus, of Wabash, is Chn. Bldg. Com.

KALAMAZOO, MICH.—Bids were received by the Michigan State Board of Education at Lansing on Aug. 14 for the construction, including heating and plumbing, of a training school at the Western Normal School at Kalamazoo. The contract has been awarded to GEORGE RICKMAN SONS CO., of Kalamazoo, for $57,500. Luther L. Wright is Secy.

NORTH CHICAGO, ILL.—Bids are asked by N. R. Usher, Acting Ch. of the Bureau of Navigation, Navy Dept., Washington, D. C., until noon, Sept. 15, for the construction of six buildings consisting of a commandant's house, four officers' houses, and a receiving guardhouse, at the naval training station, Great Lakes, North Chicago.

SIOUX CITY, IOWA.—The following bids were received on Aug. 20 by the Building Committee of the Auditorium Co. for erecting the auditorium: John J. Keefe, $41,-250; John A. Swanson, $39,289; Payette Construction Co., $43,212; William Kulme, $44,138; Smith & Small, $42,857; Babue & Son, $38,420, and W. J. Merten, $40,616.

DES MOINES, IOWA.—The contract to erect a church for the members of the University Place Church of Christ has been awarded to CHARLES WEITZ & SONS, 713 Mulberry St., at $44,000.

MINNEAPOLIS, MINN.—E. H. Hewitt, Arch., 716 Fourth Ave. South, Minneapolis, advises us the contract for foundation for the church to be built for St. Marks Episcopal Congregation, has been let to PIKE & COOK, Fourth St., South. The church will be 100 × 74 ft. and will cost $171,500. It will be constructed of stone, brick and concrete.

ATCHISON, KAN.—Following are the bids received on Aug. 10 for erecting a high school; T. H. Ludlow, Kansas City, Mo., $72,985; Blanchard Construction Co., Topeka, $82,396; Owen T. Seip & Co., Atchison, $74,206; Kaaz & Braun, Atchison, $75,-800; GEORGE H. T. SCHAEFER & CO., Atchison, $71,931 (awarded contract); H. Ellenberger, Chicago, Ill., $79,859; C. W. Benning, Kansas City, Mo., $76,100; Carl A. Nilson, Kansas City, Mo., $84,370; J. T. Patterson, Kansas City, Mo., $76,761; L. Crosby & Sons, Kansas City, Mo., $81,972; A. Ohleson, Kansas City, Mo., $75,000; Lonsdale Bros., Kansas City, Mo., $18,800; Swenson Construction Co., Kansas City, Mo., $74,840; Alexander Kinghorn & Mathers, Kansas City, Mo., $75,482; J. W. Lehr, St. Joseph, Mo., $76,542. H. B. Mize is Chn. Bldg. Com., Bd. of Education.

FORT LEAVENWORTH, KAN.—Bids are asked until 11 a. m., Sept. 16, by Capt. William D. Davis, Q. M., for the construction of an Isolation Hospital, including plumbing, hot water heating, electric wiring and electric lighting fixtures, at Fort Leavenworth.

LAWRENCE, KAN.—Bids are asked by the Regents of the University of Kansas until 11 a. m., Sept. 10, for the erection of a Mining Engineering building on the campus of the University at Lawrence; also for furnishing all labor and materials for the complete installation of a system of heating and plumbing and electric wiring in said Mining Engineering building. John F. Stanton, Capitol Bldg., Topeka, Kan., is State Arch.

ST. LOUIS, MO.—The following bids were received on Aug. 25, by the Public Library Board to erect a library building on Olive St., between 13th and 14th Sts.: Bedford limestone—John Pierce Co., $1,179,000; Westlake Construction Co., 717 Locust St., St. Louis, $1,261,200; James Black Masonry & Construction Co., $1,287,296; James Stewart & Co., 135 Broadway, New York, $1,-299,900; Hedden Construction Co., 1 Madison Ave., New York, $1,307,238; Selden-Breck Construction Co., $1,317,000; James H. Bright Contracting & Building Co., Lincoln Trust Bldg., St. Louis, $1,335,377; Norcross Bros. Co., Tremont Bldg., Boston, Mass., $1,492,000. Granite—John Pierce Co., $1,379,000; James Black, $1,458,597; Westlake Construction Co., $1,477,578; James H. Bright, $1,504,877; James Stewart & Co., $1,506,300; Hedden Construction Co., $1,-528,817; Selden-Breck Construction Co., $1,-535,000; Norcross Bros. Co., $1,608,000. Vermont marble—Westlake Construction Co., $1,346,700; James Black, $1,376,437; James Stewart & Co., $1,376,800; Hedden Construction Co., $1,389,782; Selden-Breck Construction Co., $1,406,000. Batesville (Ark.) marble—Westlake Construction Co., $1,396,-700; James Stewart & Co., $1,482,700; James H. Bright, $1,434,377; Selden-Breck, $1,-467,000. Cass Gilbert, 11 East 24th St., New York, N. Y., are Archs.

The Women's Christian Association has had plans prepared by J. Hal Lynch, Seventh and Locust Sts., St. Louis, for a blind girls' home, 100 × 142 ft., brick, with stone and terra-cotta trimmings; terra-cotta roof; electric lights to cost $60,000.

OKLAHOMA CITY, OKLA.—The Lee Huckins Hotel Co. will rebuild hotel lately burned. It will erect a 10-story office building and hotel combined on lot 85 × 140 ft., at Broadway and Main St. The south half of building to be used for hotel and to be connected with present 7-story fireproof annex by arcades on each floor. The new structure will contain banking-room, lobby, elevators, etc. The building will cost from $250,000 to $300,000. It is contemplated to award contract in about 90 days. No architect has been selected.

DENVER, COLO.—An apartment house to cost from $40,000 to $50,000, is to be erected at once at the corner of 17th and Washington Sts. by Arthur S. Miller, 1633 Champa St.

SPOKANE, WASH.—C. P. Oudin, Mgr. of the American Fire Brick Co., will build an apartment house at the corner of Third Ave. and Cedar St. It will be a semi-fireproof, the walls and partitions being of hollow tile with exterior of white pressed brick and terra cotta. The supports will be of steel and the stairs of steel and reinforced concrete. In the principal rooms the finish will be oak and red birch, stained mahogany. The main halls and the baths will be mosaics, with tile wainscot in the baths. There will be an automatic electric elevator in the building, and a dry-kiln laundry driers in the basement. The apartment house will contain 16 suites of five, six and seven rooms. It will cost about $75,000. G. A. E. Bergholtz is Arch. and C. H. Jabelonsky Constr. Engr. of the building. The plans are complete and work will start in a few days.

Col. I. N. Peyton will erect an office building on Sprague St. The building will be 84 × 90 ft., six stories high, and will cost between $250,000 and $300,000.

TACOMA, WASH.—Two fireproof hotels are to be erected in Tacoma, work to start almost immediately. Anton Huth, Pres. of the Pacific Brewing & Malting Co., will erect on three vacant lots at Jefferson Ave., South 17th and C Sts. a 7-story pressed brick hotel building, to cost between $80,-000 and $90,000. The hotel will be fireproof and will contain more than 200 rooms. Darmer & Cutting, 1111 South C St., Archs., are preparing the plans. William Virges, also of the Pacific Brewing & Malting Co., is preparing to erect a 5-story brick hotel building on the lower side of Pacific Ave., between Twelfth and 13th Sts., to cost about $90,000. Heath & Twitch, Fidelity Bldg., are Archs.

BREMERTON, WASH.—Bids were received as follows Aug. 29 by the Bureau of Yards and Docks, Navy Dept., Washington, D. C., for the construction of hospital buildings at the Puget Sound Navy Yard, Bremerton, Wash. (a) Hospital buildings proper; (b) same with addition of southeast ward and connecting corridor; (c) same omitting the operating and subsistence building with connecting corridors. Lance & Peters, Inc., Walker Bldg., Seattle, Wash., (a) $185,000; (b) $238,000; (c) $139,000. A. E. White & Franklin Fire Proofing Co., Arcade Annex, Seattle, (a) $179,401; (b) $240,000; (c) $141,-401. Kleburtz, Smith & Rowntree, New York Block, Seattle, (a) $177,345; (b) $233,-000; (c) $144,450. E. J. Rounds & Co., Globe Block, Seattle, (a) $181,000; (b) $239,-000; (c) $147,000. McInnis & Reed, Lumber Exchange, Portland, Ore., (a) $174,783; (b) $233,322; (c) $140,158. Timothy Ryan, Sullivan Bldg., Seattle, Wash., (a) $235,000. Cawsey & Lohse, Lowman Bldg., Seattle, (a) $233,215.

COALINGA, CAL.—Bids are asked until Sept. 10 by B. T. Dyer, Secy., of the Pleasant Valley Hotel Co., of Coalinga for the construction and completion of a 3-story and basement hotel building to be erected at the corner of Fifth and D Sts., in the city of Coalinga. Homer W. Glidden, 430 South Broadway, Los Angeles, Cal., is Arch.

FORT BAKER (Saussalito post-office), CAL.—Bids are asked by Maj. George McK. Williamson, Q. M., U. S. A., until 11 a. m., Sept. 19, for constructing, plumbing, heating and installing electric wiring and fixtures in two double non-commissioned officers' quarters at Fort Baker.

SAN FRANCISCO, CAL.—James Knox Taylor, Superv. Arch., Treasury Dept., has awarded contract for repairing the San Francisco post-office to RAYMOND GRANITE CO., Division and Potrero Sts., San Francisco, at $299,550. A complete list of bids, received on Aug. 10, was published on Aug. 13.

Authorization has been given by Board of Supervisors to the Department of Public Works to proceed with the erection of three engine-houses for the use of the Fire Department. One, which it is estimated will cost $23,000, is to be located on the south side of Pacific St., near Sansome. Another is to cost approximately $27,500, and is to be located on the north side of O'Farrell St., near Stockton. The third is to be built on the south side of Sacramento St. near Maple and will cost approximately $23,000. Newton Tharp is City Arch.

We are officially advised that the Board of Directors of the Union Trust Co. has approved designs of Clinton Day, Arch., Union Trust Bldg., for the bank building of the company, to be erected at the corner of Market, O'Farrell St. and Grant Ave. The building will be about 70 ft. high, with one story and galleries. The front of the building, which will be curved, will be 80 ft. and the depth on Grant Ave., 120 ft.

SANTA ROSA, CAL.—Bids were received as follows on Aug. 27 at the office of James Knox Taylor, Superv. Arch., Treasury Dept., Washington, D. C., for the construction of a post-office building at Santa Rosa, Cal.: Continental Fireproofing Co., $62,800; San Francisco Rebuilding Co., Pacific Bldg., $58,-289; Couchot & Thurston, $74,700; Hoyt Bros., Santa Rosa, $59,995; Hickon & Ehrhart Engineering & Construction Co., 960.-672. All bidders are of San Francisco, except Hoyt Bros.

LOGAN, UTAH.—The following bids were received on Aug. 24 by James Knox Taylor, Superv. Arch., Treasury Dept., Washington, D. C., for the construction of the U. S. Postoffice at Logan, Utah: Northwestern Construction Co., Waupeton, [illegible], $50,775, time, July 1, 1909. The [illegible] Co., Chicago, Ill., $47,5.0; [illegible] Hinchliff 1900. The Campbell Building [illegible], July 31, Block, Salt Lake City, Utah, [illegible] Dooley as specified.

FORT WILLIAM, ONT.—The CARTER-HALLS-ALDINGER CO. has secured the contract for the erection of the Smithertson block. Cost, $100,000.

WATER SUPPLY—IRRIGATION.

(* *denotes that this work is advertised in Engineering News.*)

BENTON, N. H.—Bids are asked by A. W. Dean, State Engr., until 5 p. m., Sept. 4, for laying about 4,000 lin. ft. of 10-in. water pipe, about 1,400 lin. ft. of 8-in. water pipe, and about 500 lin. ft. of 6-in. water pipe, all of cast iron, and for the construction of a masonry dam containing about 50 cu. yds. of cement stone masonry, at the site for the Sanatorium for Consumptives to be constructed in the Town of Benton, N. H., near Glencliffe Station.

*BRANDON, VT.—Bids were received by the Commissioners of Fire District No. 1 National Bank, for the construction of a system of water-works here. B. W. Howland is Chn. Com. Contract was awarded to CHAS. MILLAR & SONS CO., of Utica, N. Y., for about 1,200 tons of water pipe at $24.20 per ton; and to the LUDLOW VALVE CO., of Troy, N. Y., for hydrants and valves.

WEST SPRINGFIELD, MASS.—L. F. Ivers, Secy. Water Comrs., states that all bids opened on Aug. 25 for the construction of a filter at Bear Hole have been rejected. New bids were asked until Sept. 1. Probable cost, $5,000. F. A. Barbour, Tremont Bldg., Boston, Engr.

PLAINVILLE, MASS.—Bids were received by the Water Commissioners on Aug. 22 for proposed water system. The WALSH BOILER & IRON WORKS, of Springfield, Mass., was awarded contract for standpipe at $3,700. Contract for laying mains and excavating for standpipe was awarded to JOSE MORELLI, of North Attleboro, Mass., at $5,700.

BROOKLYN, N. Y.—The following bids were received on Aug. 26 by John H. O'Brien, Comr. Water Supply, Gas and Electricity, N. Y. City, for furnishing and delivering for Brooklyn Boro.: (a) 1,800 tons water pipe, per ton: (b) 50 tons special castings, per ton: (c) total cost: M. T. Drummond & Co., 180 Broadway, N. Y., (a) $22.20, (b) $48, (c) $42,360. U. S. Cast Iron Pipe & Foundry Co., 71 Broadway, N. Y., (a) $22.90, (b) $50, (c) $43,720. Warren Foundry & Machine Co., 170 Broadway, N. Y., (a) $23, (b) $46, (c) $43,700. John Fox & Co., 233 Broadway, N. Y., (a) $22.75, (b) $44.80, (c) $43,190.

COHOES, N. Y.—George T. Bolton, City Engr., is stated to be preparing plans for a quantity of water main extensions in connection with the new filtration plant which is to be constructed. Bids will soon be called for by the Water-Works Commissioners for the following quantities of cast-iron pipe: 2,50 lin. ft. of 30-in. cast-iron pipe and about 2,500 lin. ft. of 24-in. cast-iron pipe. Noted last week.

LAKEMONT, N. Y.—The contract for the new water-works system of Starkey Seminary, in Lakemont, has been awarded to L. H. DURLAND & SON, of Watkins, N. Y.

*SHORTSVILLE, N. Y.—Bids are asked by the Board of Trustees of the Village of Shortsville, until 8 p. m., Sept. 22, for constructing a complete water-works system. S. L. Heath, Village Pres.; N. Adelbert Brown, Consult. Engr., Rochester, N. Y.

HOPEWELL, N. J.—Bids will be received by E. V. Savage, Boro Clk., until 8 p. m., Sept. 10, for the construction of a reservoir and pipe line. Chas. A. Hague, 32 Broadway, New York, is Engr.

GARFIELD, N. J.—Bids are asked by the Mayor and Borough Council until 8 p. m., Sept. 4, for extending the water distribution system and for the erection of a new standpipe. Plans and specifications may be seen and blank forms of proposal obtained at the office of the Superintendent of Public Works, 86 Passaic St., Garfield, N. J., or at the office of Colin R. Wise, Borough Engr., 34 Bloomfield Ave., Passaic, N. J.

PLEASANTVILLE, PA.—Bids are asked until 4 p. m., Sept. 10, by R. M. Davidson, Chn., for the digging 4 ft. deep, leading joints and covering of about 2,500 ft. 6-in., 10,000 ft. 4-in. cast-iron pipe and 4,000 ft. 2-in. galvanized iron pipe more or less; also setting twelve hydrants more or less incident to installing water-works system. Borough to furnish all material used.

PHILADELPHIA, PA.—Bids are asked until noon, Sept. 3, by the Department of Public Works, for Contract No. 152: Apparatus for cleaning slow sand filters for the Upper and Lower Roxborough and Torresdale filters. Specifications and blank forms upon which bids must be made can be obtained at the office of the Chief of the Bureau of Water, Room 790A, City Hall, to whom all communications should be addressed. Noted Aug. 20.

CHAMBERSBURG, PA.—Bids are asked by the Town Council until 6 p. m., Sept. 7, for the construction of a concrete dam and side walls and supporting and building therein steel or wrought iron head gates, together with the removing of all trees, stumps, roots, gravel, earth, stones and materials not needed for filling.

AIKEN, S. C.—City has appointed the Solomon-Norcross Co., 1622 Candler Bldg.,

Atlanta, Ga., consulting engineer for waterworks Company to make surveys and investigations of all sources and all supplies for city and detailed estimates of cost of filter beds, pumps, power stations, also estimates of cost of municipal lighting plant. Population of Aitken, 5,000. R. W. Wessels, Chn. Water Works Com.

BARNESVILLE, GA.—City awarded contract to ALLIS-CHALMERS CO., Milwaukee, Wis., for improvements to water-works plant.

DAYTONA, FLA.—We are officially advised that the city voted $50,000 of water-works bonds on Aug. 24. D. D. & C. M. Rogers of Daytona, are Engrs.

PRATTVILLE, ALA.—City has awarded contract to Woolsey Finelle, Prattville, for construction of water-works and sewer system. The Solomon-Norcross Company, 1622 Chandler Bldg., Atlanta, Ga., is Consult. and Designing Engr.

*GULFPORT, MISS.—Bids are asked by the Mayor and Board of Aldermen until 8 p. m., Sept. 5, for the construction of a reinforced concrete reservoir.

PLEASANT HILL, OHIO.—C. Roy Coppock, Corporation Clk., states that bids will be received about Sept. 21 for the construction of water-works. Estimated cost, $16,000. A. C. Reed, of Pleasant Hill, is Engr.

CINCINNATI, OHIO.—Bids will be received until Sept. 22 by the Board of Trustees, Comrs. of Water-Works, for furnishing and delivering lime and sulphate of iron for the filtration plant of the city.

OXFORD, OHIO.—Bids will be received until noon, Sept. 16 by the President of the Miami University, Oxford, for furnishing material and constructing a system of water supply and fire lines on the campus. Gustave W. Drach, Arch., Union Trust Bldg., Cincinnati; W. L. Tobey, Chn., Bldg. Com.

*TOLEDO, OHIO.—Bids were received by the Board of Public Service on Aug. 25 for the construction of sections Nos. 1, 3 and 4 of the filtered water conduit. Reynold Voit is Secy. Bd. The bids were: A. Bentley & Sons Co., $17.50 per ft. for section 1, $14 per ft. for section 3, and $21 per ft. for section 4. Bids made on brick only.

McKinney Bros., $13.50 for brick and $12 for concrete on section 3, $14 for brick and $12.50 for concrete on section 4. No bid was made for section 1.

WATERS & TANSEY, $12.79 for either brick or concrete on section 1, $12 for either on section 3, and $11.50 for brick and $12 for concrete on section 4 (awarded contract; total bid, $133,744, if constructed of brick, and $135,712 if made of concrete. They do not include the manholes and other extras.)

Breyman & O'Neill, $15 for brick and $14.50 for concrete on section 1, $14 for either on section 3, and $14 for either on section 4.

M. M. Defrees on concrete alone, $15 on section 1, $17.25 on section 3, and $20.87 on section 4.

Reauch Construction Co., on concrete alone, $17.50, on section 1, $17.50 on section 3, and $19 on section 4.

The time given for completion is 250 days.

*EVANSVILLE, IND.—Bids are asked by the Board of Trustees of the Department of Water-Works, until 7 p. m., Oct. 12, for the construction of a mechanical filtration plant. Details are given in advertisement in this issue. W. M. Madden, Clk. Bd. Advertised on Aug. 6.

EAST LANSING, MICH.—City has voted to issue $8,750 bonds for water-works improvements. S. C. Hadden, City Surveyor.

CHICAGO, ILL.—Bids are asked until 1 p. m., Sept. 8, by the Board of Cook County Commissioners for a water-works system at Oak Forest, located on the C. R. I. & P. Ry. about 19 miles from Chicago in accordance with the plans and specifications prepared by Holabird & Roche, Archs., Chicago.

ROCK ISLAND, ILL.—Wallace Treichler, City Engr., has been authorized to prepare plans and specifications for filters and settling basins for the city water supply.

EAST MOLINE, ILL.—Bids were opened Aug. 26 by the Board of Local Improvements for furnishing material and laying water mains in portions of various streets and avenues. The contract was awarded to the MOLINE HEATING & CONSTRUCTION CO., of Moline, at $19,990. The other bids received were as follows: People's Construction Co., Davenport, Iowa, $25,945; Des Moines Bridge & Iron Co., Des Moines, Iowa, $23,428; Theo. Becker, Geneseo, Ill., $23,846; C. A. Berglund, Moline, Ill., $12,898; John W. Farley, Chamber of Commerce Bldg., Chicago, $26,000.

ROBINSON, ILL. — TROY PORTER of Paris, Ill., has been awarded contract for about six miles of new water main at Robinson, by W. H. Clinton, receiver of the water and light plant in Robinson. The price was $22,495.

NORTH CHICAGO, ILL.—Only one bid was received on Sept. 1 for the construction of a water supply intake, crib, pump well and auxiliary piping at the naval training station, Great Lakes, North Chicago, Ill.: W. H. Wheeler, 6337 Woodlawn Ave., Chicago, $17,800.

STURGEON BAY, WIS.—Bids will be received until Sept. 7, H. C. Leonhardt, City Clk., for furnishing material and installing a system of heating conduits; also a system of water mains in the streets and alleys of the city. Bids will be received on the material and labor as a whole and also on the material f. o. b. cars and the labor separately.

AMES, IOWA.—The DES MOINES BRIDGE & IRON CO., of Des Moines, has secured the contract for an extension to the distribution system of the city water-works for $14,950. Other bids received were: James M. Healy, Chicago, Ill., $16,526; R. C. De La Hunt, Cedar Rapids, $17,085; Anderson & Nelson, Boone, $15,328; Cook Construction Co., Des Moines, $15,878.

BELOIT, KAN.—The U. S. Cast Iron Pipe & Foundry Co., of Chicago, Ill., has secured the contract for furnishing f. o. b. cars Beloit, about 500 tons c. I. pipe and also special castings. Bids received on Aug. 18.

GOTHENBURG, NEB.—C. F. Williams, City Clk., states that bids will be received on Sept. 10 for the construction of water-works to cost about $35,000.

CROFTON, NEB.—City has voted to issue bonds in the sum of $10,000 for the construction of water-works.

LA MOURE, N. DAK.—City will construct water-works, consisting of a system of water mains fed by artesian wells, at a cost estimated at $28,000.

FORT LINCOLN (Bismarck postoffice) N. DAK.—Bids will be received by Lieut. Bowers Davis, Constr. Q. M., until 1 p. m., Sept. 4 for furnishing and laying water pipe at this post.

NEW HAVEN, MO.—We are officially advised that bids are asked until Sept. 14 by the City Clerk for furnishing and installing a water-works system for the city, including pipe line (4, 6 and 8-ins), hydrants, valves, concrete reservoir, air compressor, air lift pump, boiler and deep well drilling. Plans and specifications on file at the office of Edward Hebbeler, at New Haven, Mo.; and at the office of W. A. Fuller the Engr., Chemical Bldg., St. Louis, Mo.

GREENVILLE, TEX.—We are officially advised that John W. Maxcy, Consulting Engr., Binz Bldg., Houston, Tex., has been engaged by the City of Greenville to develop a water supply and to design the extensions of the water mains. The total cost of the work contemplated is $67,500, for which bonds have been issued.

AUSTIN, TEX.—The Water, Light & Power Commissioners will receive bids until Sept. 19, for constructing a concrete-steel addition to the municipal pumping station, approximately 89 × 64 × 35 ft. For specifications, blank forms and other information, address Walter C. Kirkpatrick, Engr., Jackson, Miss., or the Water, Light & Power Commissioners, Austin.

*STILLWATER, OKLA. — The American Light & Water Co., of Kansas City, Mo., has secured the contract for improvements to the lighting plant and water-works, including a filtration plant for $38,840. Bids were received on Aug. 17. Same company was awarded sewer contract at $27,000 on the unit system. The W. K. Palmer Co., Dwight Bldg., Kansas City, Mo., is Engr.

FORT MORGAN, COLO.—The contract for improving water-works at Fort Morgan has been awarded to the MINE & SMELTER SUPPLY CO., of Denver, at $8,275.

SEATTLE, WASH.—See under Streets and Roads.

KLAMATH FALLS, ORE.—Contract has been awarded to W. H. MASON, of Klamath Falls, for the extension of the South Branch Canal of the Klamath irrigation project, Oregon-California. The work consists of the construction of about seven miles of canal, involving the excavation and embanking of about 112,000 cu. yds. of material. Mr. Mason's bid amounted to $22,704.

ANGEL ISLAND, CAL.—Bids will be received until Sept. 9 by Walter J. Mathews, Arch., 969 Broadway, Oakland, for furnishing material and boring an artesian well, installing complete oil-burning equipment and oil reservoir, outside electric wiring, intercommunicating telephone system and laundry machinery in the immigration station at Angel Island, Cal.

SALT LAKE CITY, UTAH.—Bids are asked by the State Board of Land Commissioners until 2 p. m., Sept. 8, for furnishing wooden pipe in quantity: Y's, steel pipe and various equipment.

Bids are also asked until 2 p. m., Sept. 15, for the enlargement of the Sevier Valley Canal, involving approximately 112,000 cu. yds. of earthwork, 3,000 cu. yds. loose rock, 28,000 cu. yds. hardpan, and 2,000 cu. yds. solid rock. Thos. C. Calister, Secy. Plans and specifications may be seen at the office of the secretary of the state board of land commissioners, Salt Lake City, Utah, at the office of Commissioner H. N. Hayes, Richfield, Utah, or at the office of H. S. Kleinschmidt, the Engr., Salina, Utah.

LETHBRIDGE, ALTA.—The City Council has awarded the contract for a 450,000-gallon standpipe to the MINNEAPOLIS STEEL & MACHINERY CO., Minneapolis, Minn., at $14,965. The pipe is to be completed early in December.

SEWERAGE.

(denotes that this work is advertised in Engineering News.)*

PORTLAND, ME.—JOHN W. GULLIVER, 102 Exchange St., has secured the contract for constructing Morrill's corner sewer, to cost about $14,018. Bion Bradbury is City Engr.

SENECA FALLS, N. Y.—We are advised by Morrison & Farrington, Inc., Engrs., Dillaye Memorial Bldg., Syracuse, that contract for constructing disposal plant was awarded on Aug. 27 to C. T. HOOKWAY, of Syracuse, at $7,650.

BUFFALO, N. Y.—See under Streets and Roads.

FORT LEE, N. J.—Following are bids opened on Aug. 21 by the Mayor and Council for the construction of a portion of the Dead Brook sewer: Henry & Emmer, West New York, $22,614; James J. Fusco Co., Newark, N. J., $22,128; E. C. Humphrey & Co., Hackensack, N. J., $19,219; Ernest Abraham, Hackensack, $20,275, and Edward P. O'Neill, Jersey City, $17,330. Ralph D. Earle, Jr., Boro. Engr., Hackensack.

KANE, PA.—An ordinance awarding the contract for the construction of a public sewer on a certain section of Holman St. to P. MORASCO, at 48 cts. per lin. ft., has been passed by Town Council. W. A. Baker is Pres. Town Council; Claude B. Gillis is Ch. Burgess.

*NORRISTOWN, PA.—Bids are asked until 8 p. m., Sept. 30, by Charles C. Rambo, Chn. Sewer Com., for construction of any or all of the following salt glazed vitrified pipe sanitary or house drainage sewers in the Borough of Norristown, Pa., contractor to furnish everything except engineering. The estimated aggregate amount of pipe, etc., required is as follows: Main sewer, 8-in. pipe, 28,837 lin. ft.; main sewer, 10-in. pipe, 2,425 lin. ft.; main sewer, 12-in. pipe, 1,476 lin. ft.; house laterals, 8-in. pipe, 11,000 lin. ft.; 123 manholes; 34 flush tanks. S. Cameron Corson is Boro. Engr.

BALTIMORE, MD.—C. M. Hendrick, Ch. Engr. of the Sewerage Comn., is preparing plans and specifications for sewer work to be let this fall which will cost $1,250,000.

Plans have been prepared by the Sewerage Commission for the construction of the storm-water drain sewer at Forest Park. The work will be done under the supervision of B. T. Fendall, City Engr., and will cost about $30,000.

PRATTVILLE, ALA.—The city has awarded contract to WOOLSEY FINELLE, Prattville, for construction of sewer system and water-works. Solomon Norcross Co., 1622 Chandler Bldg., Atlanta, Ga., is Consult. and Des. Engr.

*VICKSBURG, MISS.—The date for opening the bids for constructing a system of house sewers has been postponed from Sept. 7 to Sept. 14. The work comprises about 30 miles of 27-in. to 8-in. pipe sewers, with necessary manholes, flush tanks, etc. Walter G. Kirkpatrick is Consult. Engr., Jackson, Miss.; H. J. Trowbridge is City Clk., Vicksburg, Miss.

CHATTANOOGA, TENN.—Robert Hooke, City Engr., has furnished estimates relative to the proposed crosstown sewer and pumping station. The pumping station will cost $26,663 and sewer will cost $60,833. The City Engineer recommends issuance of $95,000 bonds to cover all expenditures.

STEUBENVILLE, OHIO.—Bids are asked until noon, Sept. 14, for constructing the following sewers: 180 ft. brick, 5-ft. egg-shaped; 1,750 ft. brick 42-in. circular; 1,553 ft. brick, 36-in. circular; 818 ft. brick, 30-in. circular; 23 manholes; 257 ft. 24-in. vitrified pipe sewer; 2,471 ft. 18-in. vitrified pipe sewer; 1,674 ft. 15-in. vitrified pipe sewer; 4,664 ft. 12-in. vitrified pipe sewer; 772 ft. 6-in. vitrified pipe sewer; 34 manholes. J. N. Leech is City Engr.

DAYTON, OHIO.—Plans for the construction of the proposed storm water sewer in Bolender Ave., to cost $32,870, have been filed. The sewer will begin at the Miami River in Edgemont, and will extend to one block west of the Cleveland, Cincinnati, Chicago & St. Louis Ry. T. N. Pexton is Pres. Bd. Pub. Service.

LIMA, OHIO.—JULIUS FETTER has been awarded contract, at 29 cts. per cu. yd., for excavation for a 7,000-ft. 18-in. soft tile drain, average depth 5 ft. 7 ins., for the State Hospital. State will furnish the tile. Charles E. Craig is County Engr. S. A. Hoskins is Chn. Hospital Board.

YOUNGSTOWN, OHIO.—The City Council has passed a resolution to construct a subdistrict sewer in Albert St., from State to McHenry Sts.; in McHenry St., from Albert to William Sts., and in Willow St., from McHenry to McGuffey Sts. M. C. Higgins is Pres. of Council; A. W. Craver is Mayor; F. M. Lillie is City Engr.

COLUMBUS, IND.—Bids are asked by L. F. Orr, City Clk., until Sept. 9, for the construction of lateral sewer system.

BIG RAPIDS, MICH.—On Aug. 19 the citizens voted to construct a sewer here. Barney Larson is City Clerk; L. W. June, Big Rapids, is Engr.

IOLA, WIS.—It is stated that the city of Iola, Waupaca County, will construct a sanitary sewer, including 800 ft. vitrified tile sewer, septic tank, disposal plant. J. C. Lang is interested.

MAYVILLE, WIS.—Contract has been let to JAMES McCABE, of Fond du Lac, Wis., to construct 7,000 ft. of sewer in Mayville.

FOND DU LAC, WIS.—At the meeting of the Board of Public Works held on Aug. 22, the following bids were opened for the sewers on North Park Ave., North Main, Portland and Cotton Sts.: Albert Solke, 8-in. pipe, 47 cts.; 10-in. pipe, 53 cts.; 12-in. pipe, 60 cts.; manholes, $28; flush basins complete, $30; extra six branches, 50 cts. each. S. H. Cole, 8-in. pipe, 56 cts.; 10-in. pipe, 60 cts.; 12-in. pipe, 65 cts.; manholes, $25; flush basins complete, $34; extra six branches, 40 cts. each. James McCabe, 8-in. pipe, 64 cts.; 10-in. pipe, 70 cts.; 12-in. pipe, 82 cts.; manholes, $28; flush basins, $25, city to furnish iron casting.

CEDAR RAPIDS, IOWA.—On Aug. 16 the City Council authorized the construction of sanitary sewers in 14 blocks of the Eighth Ward. C. H. Streeter is City Engr.

CARROLL, IOWA.—Bids are asked until 8 p. m., Sept. 8, by J. A. Dougherty, City Clk., for labor and material for constructing 1,240 ft. 10-in., 13,770 ft. 8-in. sewer and 4,930 ft. of 6-in. subdrains.

TOPEKA, KAN.—It is proposed to construct pipe sewers in the Kenwood district at a cost of $50,000. John P. Rogers is City Engr. C. B. Burge is City Clerk.

NEWTON, KAN.—Contract has been awarded to B. P. EVANS, Topeka, Kan., at $21,675, for installing a sewer system for this city.

PRATT, KAN.—W. A. REES, of Fayetteville, Ark., has secured contract, at $21,316, for installing a sewer system.

EL PASO, TEX.—The city has obtained estimate of $25,000 on construction of proposed storm sewer on Arizona St. E. T. Todd is City Engr.

DENVER, COLO.—It is stated that a $1,000,000 sanitary sewer will be constructed on the South Side, and bids will be received soon by the Board of Public Works. It is also stated that a boulevard will be constructed from 38th and Downing Aves. to Brighton Road. John B. Hunter is City Engr.

Plans for the sewer system in the Clayton Addition to the city have been completed by the City Engineering Department, and advertisements of the improvements will be issued at once. According to the estimates the cost of the sewer will be at $18 a lot, while the total expenditure will amount to about $75,000. Specifically the district is known as No. 5 and it is expected that if the work continues without interruption from now on the improvements will be finished late in the fall or during the winter.

BELLINGHAM, WASH.—Two bids for the construction of that part of the West Holly St. trunk sewer, between C and E Sts., were presented at the meeting of the Board of Public Works recently and the contract was awarded to ROGERS & McELMON for $4,138. Charles E. Lind's bid was for $4,567. The work is to be completed by the first of the year.

SEATTLE, WASH.—See Streets and Roads.

SEATTLE, WASH.—The contract for constructing pipe sewers in Atlantic St., etc., has been let to PAUL STEENBURG, Hinckley Bldg., Seattle, at $63,958. The only other bid was submitted by Lance & Peters, Walker Bldg., Seattle, at $68,804. R. H. Thomson is City Engr.

OAKLAND, CAL.—The contract for furnishing material and constructing an extension to the storm sewer in Grove and Jones Sts., to Lake Merritt, has been awarded to CONTRA COSTA CONSTRUCTION CO., 2010 Addison St., Berkeley, Cal.

Bids are asked until 11 a. m., Sept. 16, by the Board of Public Works, Walter B. Fawcett, Secy., for the construction of a vitrified pipe sewer in Fallon St., Sixth St. and Oak St., from near Seventh St. to Second St., in the city of Oakland. Frederick C. Turner is City Engr.

ESCONDIDO, CAL.—Chick & White, Los Angeles, Cal., are reported to be low bidders for constructing sewer system to cost about $14,000 in this city.

SACRAMENTO, CAL.—On Aug. 20 the City Trustees received bids for constructing sewers in this city. Following is a list of the successful bidders and the sewers they will construct: COTTON BROTHERS & CO., Bacon Bldg., Oakland, Section 1, U St., from Fifth to Ninth Sts., $15,233; Section 2, U St., from Ninth to Twelfth, $9,115; Section 3, U St., from Twelfth to Fifteenth, $8,991; Section 4, U St., from Fifteenth to Nineteenth, $11,244; Section 5, Nineteenth St., U to S to Twentieth, $8,208; Section 6, S St., from Twentieth to Twenty-fifth, $15,786; Section 7, Twenty-fifth St., from S to the alley, P and Q, $6,244; Section 8, Twenty-fifth St., from the alley, P and Q to N, $5,739. WILLIAMS & BELSER, Section 9, I St., from Twenty-fifth to Twenty-ninth, $4,150. T. E. CLARK, Section 10, Twenty-ninth St., from I to the alley, G and H, $1,434. T. M. BURNS, Section 11, S St., from Twenty-fifth to Twenty-ninth, $5,636.

The lateral mains were awarded to the following contractors: Third St., along Third from U to the alley, X and Y, W from Third to Bannan, T. E. CLARK, $3,817; Twelfth St., along Twelfth from U to the alley, X & Y, COTTON BROS. & CO., $1,885; Fifteenth St., along Fifteenth from U to the alley, X and Y, McGILLIVRAY CONSTRUCTION CO., $2,114; Nineteenth St., along Nineteenth from U to the alley, X and Y, COTTON BROS. & CO., $1,885; Twentieth St., along Twentieth from S to the alley, O and P, was not awarded and the bids were all rejected; Twenty-fourth St., along Twenty-fourth from S to the alley, X and Y, COTTON BROS. & CO., $4,190; Twenty-fifth St., along Twenty-fifth from the alley, B & C, to the alley, F and G, COTTON BROS. & CO., $1,868; Twenty-ninth St., south along Twenty-ninth from the alley, O and P, to the alley, X and Y, COTTON BROS. & CO., $5,366; Twenty-ninth St., north along Twenty-ninth from the alley, B and C, to the alley, G and H, CHARLES MOORE & SON, $2,751; McKinley Park, along the alley, G and H, from Twenty-ninth St. to a point 100 ft. on the easterly line of Twenty-first, CHARLES MOORE & SON, $1,119.

C. C. MOORE CO., of Sacramento, has secured the contract for two boilers for the sewage pumping station, at $8,350.

STREETS AND ROADS.

(denotes that this work is advertised in Engineering News.)*

BIDDEFORD, ME.—Bids are asked until 2 p. m., Sept. 5, by the Mayor for constructing a section of State road, about 2,555 ft. long.

*FORT ANDREWS (Boston post-office), MASS.—Bids are asked until 10 a. m., Sept. 28, by Capt. Ira L. Fredendall, Constr. Q. M., 283 Summer St., Boston, for construction of macadam roads, gutters, catch basins, drains and concrete walks at Fort Andrews, Mass.

HARTFORD, CONN.—Bids are asked by the State Highway Commissioner, Capitol, Hartford, until 2 p. m., Sept. 7, for State road work as follows: Town of Winchester, 4,461 lin. ft. macadam: one 24-in., one 18-in, and one 15-in. tile culvert required. Town of Suffield, 1,315 lin. ft. macadam. Town of North Canaan, 3,700 lin. ft. macadam grade, one 24-in. and one 15-in. tile culverts required. Town of Trumbull, two sections, 5,700 lin. ft. macadam-telford: two 15-in. tile culverts required. Town of Granby, 10,600 lin. ft. macadam-grade; two 15-in. tile culverts required. Town of Newington, 18,475 lin. ft. macadam-gravel: one 20-in., two 18-in., one 30-in., four 24-in., and two 15-in. tile culverts required.

HARTFORD, CONN.—The following contracts for State road construction, bids for which were received Aug. 24, have been awarded by the State Highway Commissioner:

Town of Windsor Locks, 4,730 lin. ft. macadam and telford road to A. BRAZOS & SONS, Middletown, $1.98 for macadam and $2.85 for telford, $100 for cobble work.

Town of Westbrook, 9,000 lin. ft. special treatment of 2-in. macadam, to PIERSON ENGINEERING & CONSTRUCTION CO., Bristol, 50 cts. per lin. ft.

Town of Wethersfield, 11,125 lin. ft. mac-

adam and telford road to A. BRAZOS & SONS, Middletown, $1.86 for macadam and $2.54 for telford, 85 cts per lin. ft. for drain.

Town of Washington, 2,500 lin. ft. macadam road to B. D. PIERCE, JR., CO., Bridgeport, $2.83 per lin. ft., $4.75 per cu. yd. for retaining wall, and 65 cts. per sq. yd. for cobblestone gutters.

Town of Meriden, 900 lin. ft. drain and special surface treatment, to THOMAS KEARNEY, Meriden, 95 cts per lin. ft.

Town of New Canaan, 3,657.7 lin. ft. macadam road, to B. D. PIERCE, JR., CO., Bridgeport, $2 per lin. ft., $4.75 per cu. yd. for retaining wall and 65 cts. per lin. ft. for cobblestone gutters.

Town of Stratford, 3,116 lin. ft. macadam, to B. D. PIERCE, JR., CO., Bridgeport, $1.39 per lin. ft. and $1 per lin. ft. for drain.

Town of Rocky Hill, 7,100 lin. ft. macadam and telford road, to C. W. BLAKESLEE & SONS, New Haven, $1.65 for macadam and $2.40 for telford, 24 cts per lin. ft. for railing.

Town of Ashford, five sections graded and telford, 2,673 lin. ft., to A. BRAZOS & SONS, Middletown, $5,300.

City of New London.—The contract for the construction of 7,315 lin. ft. of macadam and telford road on Jefferson Ave., to F. ARRIGONI & BRO., Durham, Conn., for approximately $15,869. Four 12-in. tile culverts called for.

Town of Norwalk, 8,750 lin. ft. gravel-telford road, to JOHN F. KNAPP, Belden Hill, R. F. D., Conn., 85 cts. for macadam and $1 for telford. Other bidders were: B. N. Beard Co., Shelton, $1.50 and $2; A. N. Clark & Son, Milford, $1.60 and $1.58; J. J. Donahue, Middletown, $1.49 and $1.96; T. F. Foley, Norwalk, $1.19 and $1.73; T. H. Gill Co., Boston, Mass., $1.69 and $1.45; O. T. Benedict, Pittsfield, Mass., $1.49 and $1.99.

The Board of Contract and Supply has awarded the contract for paving American Row, State St. and Central Row with asphalt and granite block to the SOUTHERN NEW ENGLAND PAVING CO. for the lump sum price of $18,385. A. W. Byrne, of Boston, Mass., was the only other bidder, $21,063.

SOUTHINGTON, CONN.—The Borough of Southington at a special meeting held Aug. 28 made an appropriation of $14,500 to macadamize Eden St. from its intersection with Bristol St. to the Safety Ave. crossing. Samuel H. Mackenzie is Engr.

TROY, N. Y.—Bids submitted to the Board of Contract and Supply on Aug. 21 for opening Ave. B were as follows: Martin Murray, $33,511; Frank Beech, $34,847; Robert I. Gleason, $35,010; Golden & Lansing, $38,212; W. G. Paterson, $39,379; A. A. Parker, $41,318.40; John Flynn, Jr., $42,298; E. H. McKenna, $42,529; McDonough Construction Co., $58,527. MARTIN MURRAY has been awarded the contract. James B. Riley is Secy. Bd.

BUFFALO, N. Y.—Contract has been let to H. P. BURGARD CO., 275 Lathrop St., at $5,200, for paving Bristol St.; GEORGE C. WAITE, at $1.595, for sewer in Pfaulder St.; GEORGE W. MOORE, at $1,298, for sewer in Germania St.

MOUNT KISCO, N. Y.—Bids will be received until Sept. 8 by the Town Board for macadamizing, grading and otherwise improving a highway leading from Katonah Village to Cross River Bridge, a distance of about a mile. Joseph E. Merriam is Town Clk.

LONG ISLAND CITY, N. Y.—Contracts have ben let to the BARBER ASPHALT PAVING CO., 30 Church St., New York, at $11,618, for regulating, grading and paving with asphalt blocks on Onderdonk Ave.; CONTINENTAL ASPHALT CO., at $9,315, for laying sidewalks and paving with asphalt blocks on Academy St.; WILLIAM HOWE, $2,112, for constructing sewer in Third Ave.

NEW YORK, N. Y.—Bids are asked until 2 p. m., Sept. 14, by John F. Ahearn, Pres. Boro. of Manhattan, for maintaining the asphalt pavement on the following streets, where the original contracts have been abandoned, in the Borough of Manhattan, City of New York: Spring St., from Hudson to Greenwich Sts.; Spring St., from Sullivan to Clarke Sts.; Clarke St., from Broome to Spring Sts.; Ninth St., from Stuyvesant St. to University Pl.; University Pl., from south side of Waverly Pl. to north side of Fourth St.; Waverly Pl., from Broadway to Fifth Ave.; Washington Pl., from Broadway to University Pl.; Mercer St., from Fourth to Eighth Sts.; Fourth St., from Broadway to Macdougal St. The Engineer's estimate of amount of work to be done is as follows: 4,800 sq. yds. of asphalt pavement; 100 sq. yds. of old stone pavement.

Sixth St., from Lewis St. to Ave. D; Seventh St., from Lewis St. to Ave. C; Lewis St., from Houston St. to south side of Third St.; from 75 ft. north of Fourth St. to south side of Fifth St., from 30 ft. north of Fifth St. to Eighth St.; 45th St., from Sixth to Eighth Aves.; 19th st. from Sixth to Seventh Aves.; 20th St., from Fourth Ave. to Broadway; Astor Pl., from Broadway to Fourth Ave.; Eighth St., from Broadway to Fourth Ave. The Engineer's estimate of amount of work to be done is as follows: 1,500 sq. yds. of asphalt pavement; 100 sq. yds. of old stone pavement.

28th St., from Eighth to Ninth Sts.; Dutch St., from John to Fulton Sts. The Engineer's estimate of amount of work to be done is as follows: 580 sq. yds. of asphalt pavement; 50 sq. yds. of old stone pavement.

Bids are asked by Bird S. Coler, Pres. Boro. of Brooklyn, until 11 a. m., Sept. 16, for regulating and repaving with granite pavement on a concrete foundation the roadway of 20th St., from Seventh Ave. to Prospect Park West, together with all work incidental thereto; for grading lots on Bay 34th and Bay 35th Sts., between 86th St. and Benson Ave., known as Nos. 26, 54, 63, 66 and 69, Block 6862; for grading lot on the northeast corner of Sterling Pl. and Troy Ave., known as No. 1, Block 1371.

NEW YORK, N. Y.—Bids are asked until 3 p. m., Sept. 10, by the Park Board, Henry Smith, Pres., for furnishing all the labor and materials necessary to grade Greenpoint Park, Boro. of Brooklyn, together with all the work incidental thereto.

The following are the bids received on Aug. 25 by Louis F. Haffen, Pres. Boro. of the Bronx, for (a) 22,000 cu. yd. 1½-in. trap rock stone, (b) 8,000 cu. yds. ¾-in. trap rock screenings, (c) total: Clinton Point Stone Co., 115 Broadway, (a) and (b) $1.90, (c) $57,000; J. E. Conklin (a) and (b), $1.98, (c) $59,400.

The following bids were received at the same time by Louis F. Haffen, Pres. Boro. of the Bronx, for repaving with granite block pavement on concrete foundation, Third Ave., from East 138th St. to East 148th St., and setting curb: Atlantic Contracting Co., 230 West 42d St., $51,277; Bart Dunn, 444 East 68th St., $57,696; Asphalt Construction Co., $52,377; F. V. Smith Construction Co., $59,992.

The bids received on Aug. 25 by Lawrence Gresser, Pres. Boro. of Queens, for regulating, grading and curbing, flagging and paving with asphalt block pavement on a concrete foundation the roadway of Halsey St., from Fulton Ave. to Franklin St., First Ward: Barber Asphalt Paving Co., 114 Liberty St., $7,266; Hastings Paving Co., 26 Broad St., $6,928; Long Island City Contracting Co., Long Island City, $7,006; Asphalt Contracting Co., Madison Ave. and 137th St., $7,243.

Following are bids received on Aug. 25 by Lawrence Gresser, Pres. Boro. of Queens, for regulating, grading and curbing, flagging with bluestone and paving with asphalt block pavement on a concrete foundation the roadway of Hunter Ave., from Jane St. to Harris St., First Ward: Barber Asphalt Paving Co., 114 Liberty St., $10,028; Hastings Paving Co., 25 Broad St., $13,161; Continental Asphalt Paving Co., Division St., L. I. City, $13,310; Asphalt Construction Co., Madison Ave. and 137th St., informal.

The bids received by Lawrence Gresser, Pres. Boro. of Queens, on Aug. 25, for regulating, grading, curbing and recurbing, flagging and reflagging, setting and resetting, bridgestones and repaving with granite block pavement on a sand foundation the roadway of Jackson Ave. and intersecting streets, from Skillman Ave. to Rapelye St., First Ward, were as follows: R. P. Greene, informal; Thomas Tarpy, 517 E. 60th St., $19,018; Peace Bros., Flushing, L. I., $24,160; Henry K. Wallen, P. O. Building, Jamaica, L. I., $32,845; Long Island Contracting Co., Long Island City, $32,863; Atlanta Contracting Co., 230 East 42d St., $23,401.

EDGEWATER, N. J.—Bids will be received by the Borough Council, Clarence E. Booth, Clk., until Sept. 14, for grading, macadamizing, guttering and otherwise improving River Road, about 12,867 ft. Watson G. Clark, of Tenafly, N. J., is Boro. Engr. George A. Carleton, Mayor.

WOODBURY, N. J.—The Gloucester County Board of Freeholders have awarded the contract for resurfacing the Crown Point road to the IMPERIAL ROAD CO., at $1.12 per sq. yd. for telford.

NEWARK, N. J.—The following bids have been received by the Roads and Assessments Committee of Board of Freeholders, for grading and paving a portion of Fairview Ave.: P. A. Matthews, of Caldwell, $17,748; F. A. Marley, $18,190; Alfonso Russamano, $33,917; Francisco Bros., $19,800; B. F. Shanley Co., $25,000; Harrison Construction Co., 837 Broad St., $25,415; John Doriety & Sons, 168 Ridge St., $19,799; Donato Fusco, $21,148.

BRANCHVILLE, N. J.—JOHN C. TIERNEY has secured the contract to macadamize 3¼ miles of road leading from Branchville over the Blue Mountains.

ATLANTIC CITY, N. J.—The Street Committee of Councils on Aug. 24 awarded the contract for the paving of Hancock, North Washington and Grant Sts. to the H. G. MULOCK CO., of Atlantic City.

OAKMONT, PA.—Bids are asked until 7.30 p. m., Sept. 7, by W. W. Kerr, Clerk Boro. Council, for improving Tenth St., between E and H Sts. Approximate quantities are: Grading, 1,000 cu. yds.; concrete curb and gutter, 2,500 lin. ft.; brick paving, 3,400 sq. yds. Also for improving E St., from Tenth to Eleventh Sts. Approximate quantities are: Grading, 270 cu. yds.; concrete curb and gutter, 800 lin. ft.; brick paving, 1,100 sq. yds.

PITTSBURG, PA.—The city has awarded following contracts for paving: BOOTH & FLINN, 504 Court St., at $67,559, for paving Forward Ave.; at $4,000 for paving Cecil Pl., and $9,695 for paving Craig St.; BARBER ASPHALT CO., 30 Church St., New York, N. Y., at $45,080, for paving Reynolds St.; M. O'HERRON & CO., at $26,704, for paving Lemington Ave.

FAYETTEVILLE, N. C.—The city has contracted with ATLANTIC BITULITHIC CO., of Charlotte, N. C., at $90,000, for construction of pavements; $270,000 available. J. F. L. Armfield is Chn. St. Com.

MEMPHIS, TENN.—We are advised by J. H. Weatherford, City Engr., that the following bids were received on Aug. 24 for 65,000 sq. yds. of asphalt pavement on Madison Ave.: H. P. Streicher & Co., Spitzer Bldg., Toledo, Ohio, $136,350; Barber Asphalt Paving Co., First National Bank bldg., $174,150; Memphis Asphalt & Paving Co., Tennessee Trust Bldg., Memphis, $158,250.

BELLE VALLEY, OHIO.—Bids are asked until noon, Sept. 7, by the Mayor, for grading and for piking with crushed limestone.

WAPAKONETA, OHIO.—The City Council has awarded the contract for the paving of Pearl St. to the J. E. CONLEY CO., of Dayton, Ohio, at its bid of $49,402 for gravel concrete and Trimble block. This was the lowest bid of 16. The successful bidder entered into a contract and bond to complete the pavement over a mile long by Dec. 31, and guarantee it for five years.

PAINESVILLE, OHIO.—Contract for the construction of an improved macadam road in the townships of Leroy and Concord has been awarded to C. F. CALLAGHAN, of Bellevue, Ohio, for $15,200. Work on the construction is to begin on or before Sept. 1 and completed by Dec. 15. The improved road is to be built along the old plank road for a distance of 2½ miles north and west from Weed's Corners in Leroy toward this city. D. W. Seitz, Columbus, Ohio, is Deputy Highway Comr.

CAMBRIDGE, OHIO.—Bids are asked until noon, Sept. 10, by the Board of Public Service, John McBurney, Pres., for furnishing 28,296 sq. yds. vitrified paving block needed for the improvement of sundry streets in Cambridge.

CLEVELAND, OHIO.—Bids are asked until 11 a. m., Sept. 19, by the Commissioners Cuyahoga County, Cleveland, for grading, draining and improving Canal Road, from Brecksville Road in Newburg Heights village, to the south line Button Road, in South Newburg village. A. B. Lee is County Surv.

CINCINNATI, OHIO.—Bids are asked until noon, Sept, 25, by the Board of County Commissioners, Stanley Struble, Pres., for Specifications No. 788: Improvement of the Rich Road, from Fallis Road to Loveland Pike, Symmes Township.

CANFIELD, OHIO.—Bids are asked until noon, Sept. 21, by the Village Council for laying sidewalks. J. R. Taber is Clerk.

FRANKFORT, IND.—Bids are asked until Sept. 14, by the Commissioners of Clinton County, Frankfort, for construction of about 30 gravel roads in Clinton County. Charles F. Cromwell is County Audr.

COLUMBUS, IND.—Bids are asked by John M. Davis, Audr. Bartholomew County, until 10 a. m., Sept. 8, for construction of 11,630 ft. of macadam road.

COVINGTON, IND.—Bids are asked by the Commissioners of Fountain County until 2 p. m., Sept. 8 for the construction of a stone road. William B. Gray is County Audr.

WASHINGTON, IND.—Bids are asked by Thomas Nugent, Audr. of Daviess County, until 2 p. m., Sept. 8, for the construction of three gravel roads known as the Hays, the Hatfield and the Ford roads.

INDIANAPOLIS, IND.—The Park Board has awarded a contract for the grading necessary for the Fall Creek Boulevard to the MANSFIELD CONSTRUCTION CO., at 29 cts. a cu. yd.

MATTHEWS, IND.—The Commissioners of Grant County are asking for bids for construction of the County Line gravel road, which includes Main St., in this city.

LA FAYETTE, IND.—Bids are asked by the Commissioners of Tippecanoe County until 10 a. m., Sept. 11, for construction of a gravel road in Fairfield Township. J. P. Foreman is County Audr.

HUNTINGTON, IND.—Bids are asked by the Commissioners of Huntington County until Sept. 18 for the construction of 15,432 ft. of gravel road.

FRANKFORT, IND.—Bids are asked by the Commissioners of Clinton County until Sept. 29 for the construction of 25 district gravel roads.

ROCKFORD, ILL.—It is proposed to pave Main and State Sts. with asphalt at a cost of $73,000. Bids have not been asked for this work. Mark Jardin is Pres. Bd. of Local Improvements; S. B. Hand is City Engr.

JEFFERSON, IOWA.—Bids are asked until 2 p. m., Sept. 7, by the Board of Supervisors of Greene County for excavation and lowering of the grade of Danger Hill, on the Scranton-Jefferson Road, three miles west of Jefferson. The work will consists of about 11,000 cu. yds. of earth excavation. C. P. Walker is Chn. Com.

SAN ANTONIO, TEX.—The following bids were received on Aug. 20 for paving Houston St.: Oaklander Bros., Waco, Tex., excavation, per cu. yd., 80 cts.; cu. yd. of fill, 45 cts.; sandstone curbing per lin. ft., in place, 70 cts.; granite, $1.70; vitrified brick per sq. yd., asphalt filler, $1.90; cement filler, $1.67; for concrete foundation (city to furnish material), actual cost of labor, plus 35%. P. T. Shields, excavations, 65 cts.; fill, 18 cts.; curbing, standstone, 66 cts.; granite, $1.50; brick, $1.58¼ for cement filler, $1.68¼ asphalt filler; for concrete foundation, same as above, except plus 20%. David R. McCormick, St. Louis, Excavation, 90 cts.; fill, 1 ct.; sandstone curbing, 75 cts.; Trinidad Lake asphalt or its equal, $1.92; for concrete foundation, same as above, except 15%. The same company submits bids for vitrified brick as follows: With asphalt filler, $2.03; cement filler, $1.95.

DENVER, COLO.—See under Sewers.

SEATTLE, WASH.—The Board of Public Works has awarded contracts for the following street improvements: Grand Boulevard, water mains, J. H. MENDENHALL, $17,942; 18th Ave., Northwest, W. F. MANNEY & CO., $15,910; 14th Ave., Northeast, asphalt paving, etc., SPARKER CONCRETE CO., $33,992; 15th Ave., Northeast, concrete walks, W. H. SMITH, $3,491; Russell Ave., grading, F. W. STEIGER & LEE, $3,890; First Ave., Northeast, sewers, F. C. POWELL, $5,560; West 62d St., sewers, H. DAHLSTROM, $4,387; alley in Block 45, A. A. Denny's Addition, asphalt paving, INDEPENDENT ASPHALT PAVING CO., $1,984; Lee St., sewers, YOUNG & UHRICH, $3,090; 22d Ave., South, sewers, T. I. PETERSON, $7,354; 21st Ave., South, sewers, YOUNG & UHRICH, $1,441; 20th Ave., South, sewers, YOUNG & UHRICH, $2,442; First Ave., South, sewers, NELSON & CARLSON, $4,590; alley in Block 135, A. A. Denny's Addition, asphalt paving, INDEPENDENT ASPHALT PAVING CO., $2,524; Highland Pl., water mains, ELLIOTT BAY IRON WORKS, $3,501; alley in Block 34, Pontius Addition, grading, JOHN L. STANLEY, $1,600; Atlantic St., sewers, PAUL STEENSTRUP, $63,958; Seventh Ave., North, concrete sidewalks, $3,708.

The City Council of the City of Seattle has passed ordinances providing for the following street improvements: 14th Ave., Northwest, grading and concrete sidewalks, $4,400; Walden St., attaching hydrants to existing mains, $1,600; 17th Ave., South, water mains, $24,800; 20th Ave., South, wood walks, $1,120; 22nd Ave., Northwest, planking, $1,100; West 56th St., sewers, $4,000; Ninth Ave., North, sewers, walks, $16,200; Lane St., concrete, $4,900; West 60th St., sewers, $12,[illegible]; 14th Ave., West, concrete walks, $8,34[illegible]; [illegible]th Ave., North, water mains, $13,80[illegible]; [illegible]n Ave., St., sewers, $17,500; Eighth [illegible]t Boston walks, $1,600; Minor Ave., [illegible], wood paving, $142,000; alley in Block [illegible] asphalt Hill, asphalt paving, $3,3[illegible]; Capitol South, water mains, $64,800; [illegible]th Ave., water mains, $6,400; Seventh [illegible]am Ave., water mains, $5,600; 23d Ave., North, mains, $8,300; Judkins St., [illegible], water Loretta Pl., grading, etc., $4,[illegible]; $11,900 water mains, $12,225; Elmwood [illegible]th Ave., $1,100; Fourth Ave., South, sewers, $42,100; West 47th St., plank [illegible]; $3,900; 12th Ave., West, water mains, [illegible]; Boyer Ave., water mains, $8,200; [illegible]th Ave., Northeast, grading, $6,300; E[illegible]th Ave., Northeast, grading etc., $4,950.

SAN FRANCISCO, CAL.—The State Harbor Commission received bids [illegible] follows Aug. 13 for paving portions of [illegible]st, Berry and King Sts.: C. S. Harney, $2[illegible]; Warren Improvement Co., $32,007; [illegible]ricka Construction Co., 50 West Mission [illegible], $31,048; Benj. M. Cram, $30,554; Bi[illegible]d-Brown Co., $29,840; Flinn & Treacy, $[illegible]234.

WILLOW, CAL.—Bids will be received by the Board of Supervisors of Glen County, at the office of W. H. Sale, County Clerk, until 10 a. m., Sept. 10, for constructing fill and grade, same being the west approach to the Glanella bridge, in Road District No. 2. Supervisor District No. 2.

CALGARY, ALTA.—The KETTLE RIVER QUARRY CO. has secured the contract for street paving here. Price, $135,000 for creosote blocks.

PRINCE RUPERT, B. C.—The Grand Trunk Pacific Ry. Co., which owns this city (which is the Pacific Coast terminus of its transcontinental system) announces that approximately $1,000,000 will be spent in grading the streets here, preparatory to putting the lots on the market. F. W. Morse, Gen. Mgr., Monreal, Que.; G. A. Ryley, Land Comr., Montreal.

MANUFACTURING PLANTS.

(* *denotes that this work is advertised in Engineering News.*)

SALEM, MASS.—Cass & Daley, shoe manufacturers, have had plans made for a 4-story shoe factory building, 50 × 200 ft. It will be of frame and brick construction, with open plumbing, electric fixtures, flat tar and gravel roofing, etc. Joseph E. Daley is Mgr., Skerry St.

MONSON, MASS.—The J. W. BISHOP CO., 107 Foster St., Worcester, Mass., has secured the contract for a factory building to be erected at Monson, for A. D. Ellis Co. E. C. & G. C. Gardner are Archs., 33 Lyman St., Springfield, Mass. Noted on Aug. 6.

GLOVERSVILLE, N. Y.—Fownes Bros. & Co., of Worcester and London, Engr., are to open a branch glove factory in this city. Ernest Smellie, Gen. Supt. of the American interests of the firm, has purchased a plot of ground on South Main St., from Frank Curtin, of the firm of Curtin & Hebert. Workmen will at once begin to tear down the shop and barns and on Sept. 15, the house on the land will be vacated and razed. It is the intention of the firm to begin building this fall.

NEW YORK, N. Y.—William M. Farrar, Consult. Engr., 156 Fifth Ave., is preparing plans for a 7-story light manufacturing building for the Marmac Construction Co., H. B. McLellan, Pres. Cost, $45,000.

BUFFALO, N. Y.—JOHN LENZ has secured contract to erect an addition to the tin shop for Hornung & Wolf, 165 Adams St. The building will be of brick, two stories high, and will cost $30,000. Wannenwetsch & Co., 563 William St., Buffalo, are Engrs.

GENEVA, N. Y.—The Standard Optical Co., 160 Lyceum St., is having plans prepared for a 2-story reinforced concrete factory building to cost $25,000.

ROCHESTER, N. Y.—A company has been formed to erect two paper mills in this vicinity, one in the city at Colvin and Wright Sts., and the other on Irondequoit Creek. The one in the city it is planned to erect this year. It will have a capacity of four tons of waxed paper and tons of tissue paper daily, and the Irondequoit plant, which is to be erected in the spring, will have a capacity of 150 tons of print paper. The latter plant will be situated between the bay and the New York Central tracks. The officers of the corporation are: W. H. Hoffman, Little Falls, Pres.; John A. Lewis, Vice-Pres.; Robert E. Gay, Treas.; Edward F. Hoffman, Secy., all of Rochester. The directors are John R. Taylor, Frank P. Crouch, John A. Levis, Robert E. Gay, Fred E. Locke and E. F. Hoffman, of Rochester, and William H. Hoffman of Little Falls.

NORTH TONAWANDA, N. Y.—The American District Steam Co., Charles R. Bishop, Secy., and Gen. Mgr., Lockport, N. Y., has invited bids for the following buildings, to be built to replace those recently destroyed at North Tonawanda. Each contractor is to submit plans with bid for buildings of the following dimensions, material to be used in construction to be determined later: Foundry building, one story, 100 × 120 ft., with wings 40 × 50 ft. and 36 × 118 ft.; dry kiln building, one story, 36 × 150 ft.; casing mill, one story 50 × 175 ft., with section, two stories 62 × 50 ft.; machine shop, two stories, 50 × 200 ft.; remodeling and rebuilding after fire of boiler and engine room, 30 × 40 ft.

NIAGARA FALLS, N. Y.—The Development & Funding Co. will erect a steel and reinforced concrete addition to its factory, 112 × 46 ft. and a brick, cement and frame repair shop, 136 × 36 ft. at a cost of $24,000 for both buildings. A high brick wall will also be erected around the factory premises.

ELIZABETH, N. J.—The Richard D. Kimball Co., Consult. Engrs. 437 Fifth Ave., New York, have prepared plans for rebuilding a 2-story factory building, at Elizabeth, for Jenkins Bros.

PERTH AMBOY, N. J.—Plans have been prepared by Gustav N. Liebous, Maurer, N. J., for a factory building for American Waterproof Cement Co., Perth Amboy. Concrete walls and roof will be constructed.

PASSAIC, N. J.—Contract will be let at once for a 2-story cold storage and fertilizer plant for the Henry Mubs Co., Passaic. Charles E. White is Arch.

GLENFIELD, PA.—Gaffey & Plagwitz, Const. Engrs., Commonwealth Bldg., Pittsburgh, are preparing plans for a warehouse for the Illinois Leather Co., Glenfield, Pa. The structure will be mill construction, brick building 100 x 150 ft. three stories high.

PHILADELPHIA, PA.—C. C. Knight dealers in iron and steel, 16th and Callowhill Sts., have had plans prepared by Watson, Huckle & Co., 1211 Walnut St., for a 6-sty factory and warehouse building to cost $150,000.

SHARON, PA.—WALLIS & CARLEY have secured the contract for the erection of the new Howard manufacturing plant, which is to be located in the Budd field, south of the town. The ground is being broken and it is probable that the buildings, two brick and one frame, will be completed by Jan. 1. The company is capitalized at $75,000.

BALTIMORE, MD.—Louis N. Bancke, Vice-Pres. and Gen. Mgr. of the Baltimore Retort & Fire Brick Co., whose plant was destroyed by fire on Aug. 17, has announced that a plant will be constructed on the old site as soon as the fire insurance matters are adjusted. The temporary office of the company is at 1100 Hull St.

WASHINGTON, D. C.—The Washington Railway & Electric Co. has purchased four acres of unimproved land on the west side of the Georgetown and Rockville tracks, about 200 yds. south of the District line, on which it proposes to erect a new car house to replace its old barn on the right side of the line a short distance above Georgetown.. H. W. Fuller, 14th and East Capitol Sts., is Gen. Mgr.

CAPE HENRY, VA.—The Cape Henry Granite Brick Co.'s plant which was destroyed by fire on Aug. 15, will be rebuilt at once. The plant is located about two miles from Cape Henry, and manufactures granite-colored brick from the white clay of that section.

RICHWOOD, W. VA.—The William F. Mosser Co., of Fayetteville, W. Va., is preparing to erect a tannery at Richwood with 1,200 vats. A contract for 2,000,000 ft. of lumber to be used in the construction work has been awarded the CHERRY RIVER BOOM & LUMBER CO'

VASS, N. C.—A. Cameron, of Vass, N. C., will build a mill for the manufacture of cotton yarns. He has awarded contract to T. B. CREEL, of Aberdeen, N. C., for the erection of the main building, 78 x 228 ft., with capacity for 5,000 spindles.

CORDELE, GA.—The Read Phosphate Co. has awarded contract to HUGGER BROS., Montgomery, Ala., for construction of the proposed $50,000 fertilizer plant. The main building will be four stories high, of wood, connected with dump shed. There will be a fireproof engine and boiler house, tanks, oilhouse and offices in separate buildings. Site, 320 x 880 ft.; capacity of plant, 25,000 tons per season; J. F. T. Clement will be Gen. Supt.

TAMPA, FLA.—See under Buildings.

NEW DECATUR, ALA.—The Decatur Cornice & Roofing Co. will build an addition to more than double floor space and manufacturing facilities. It will erect reinforced-concrete or brick building, 135 x 135 ft., three stories high, with individual electric motor-driven machinery, electric freight elevator, heating plant and automatic sprinkler system for fire protection. Construction is to begin within 30 or 60 days and to be completed by January. Architect not engaged and correspondence is invited, especially as to reinforced-concrete construction.

LEXINGTON, KY.—The COMBS LUMBER CO. has been awarded the contract for the erection of a car house and repair shop for the Lexington & Interurban Railways Co. The Combs Lumber Co. has sublet the concrete foundation work to F. T. JUSTICE & Co. John B. Crawford, Lexington, is Gen. Mgr.

FRANKFORT, KY.—Bids are asked by the State Board of Control for Charitable Institutions until noon, Sept. 8, for the erection of a laundry building on premises of the Feeble Minded Institute. Plans, etc., have been prepared by Murphy & Bro., Archs., 250 Fifth St., Louisville. Albert Scott is Pres.

NORWALK, OHIO.—It is stated that B. A. Worthington, Receiver of the Wheeling & Lake Erie R. R. Co., has definitely decided to rebuild in this city the shops destroyed by fire at a loss of $300,000. The insurance, nearly $100,000, is to be used in the restoration of the shops. It was also reported that Mr. Worthington has announced that if the people of Norwalk would aid the shops would be doubled in capacity.

AKRON, OHIO.—The Osborn Engineering Co., Osborn Bldg., Cleveland, has let general contract to the NATIONAL CONCRETE FIREPROOFING CO., 2561 East 89th St., Cleveland, for a 5-story factory building for the Goodrich Rubber Co., Akron.

EAST LIVERPOOL, OHIO.—The GUY JOHNSTON CONTRACTING CO., of Toronto, Ohio, has been awarded the contract for the car house to be erected by the Ohio Valley Traction Co., in the East End, East Liverpool. The building will be built of brick and steel, and it is estimated will cost $40,000.

CLEVELAND, OHIO.—The Cleveland Foundry Co. is having plans drawn for a stove factory of five stories with basement, 60 x 200 ft. The structure will be of heavy mill construction.

DAYTON, OHIO.—Plans have been prepared by the Dayton Paper & Novelty Co. for erecting a 4-story concrete building. The building will be built at the site of the present plant, 1126 East Third St.

CINCINNATI, OHIO.—A. C. Andrews will erect a factory to cost $80,000, at Sixth and College Sts. The building will be twelve stories high and will be constructed of brick, stone and concrete.

SOUTH BEND, IND.—Plans are being prepared by R. K. Schuter, Arch., Sumner Block, South Bend, for a 4-story cracker factory to be built here for the South Bend Biscuit Co. Estimated cost, $40,000.

PORT HURON, MICH.—The Grand Trunk Railway System has plans for a wood machine shop, with 10,000 sq. ft. of floor space, in connection with the system's car shops. Alterations will be made at the power house. J. L. Hodgson, Port Huron, is Master Car Builder.

MILWAUKEE, WIS.—The Pfister & Vogel Leather Co. has obtained a permit to erect an addition to its tannery, at a cost of about $110,000.

ST. LOUIS, MO.—A 3-story factory building is to be built by the G. V. Brecht Butcher Supply Co. The structure will cost $25,000.

CLOVIS (Texico post-office), N. MEX.—Contract has been let by C. A. Morse, Engr., Topeka, Kan., to CHARLES FELLOWS, of Los Angeles, Cal., for construction of a machine shop, storehouse and blacksmith shop for the Atchison, Topeka & Santa Fe Ry. Co. W. F. Buck, Chicago, Supt. of Motive Power. Cost, $35,000.

WINNIPEG, MAN.—The Canadian Elevator Co., Grain Exchange, Winnipeg, is arranging to construct a number of grain elevators of 30,000 bushels capacity each, along the lines of the Grand Trunk Pacific Ry. W. H. McWilliams is Mgr.

MINNEDOSA, MAN.—The Canadian Pacific Ry. Co.'s roundhouse here has been destroyed by fire. It will be rebuilt at once. Grant Hall, Winnipeg, is Supt. Motive Power (Western Lines).

MISCELLANEOUS CONTRACTS.

U. S. RECLAMATION SERVICE.—Items regarding irigation, canal projects, etc., will be found under Water-Supply—Irrigation.

RIPRAP WALL.—Oakland, Cal.—Bids are asked by the Board of Public Works until 10 a. m., Sept. 16, for construction of a riprap wall.

DITCH.—Marshalltown, Iowa.—Bids are asked until noon, Sept. 9, by Erastus Cornell, County Audr., for constructing Marshall Drainage Ditch No. 3.

DAM.—Port Arthur, Ont.—Bids are asked by J. M'Teigue, City Clerk, until 6 p. m., Sept. 7, for the construction of a concrete dam at Current River Park.

DITCH.—Paragould, Ark.—Bids are asked until Sept. 9 by C. W. Highfill, Clk. of Greene County, for constructing a ditch. Lund & Hill, of Little Rock, are Engrs.

RETAINING WALL.—Rushville, Ind.—Bids are asked by the Board of County Commissioners until 2 p. m., Sept. 7, for construction of a retaining wall on road east of Big Flatrock Creek.

COPPER WIRE.—Buffalo, N. Y.—Bids will be received Sept. 4 by the Fire Commissioners, Simon Seibert, Chn., for 34 miles of No. 10 plain, and 26 miles of No. 10 insulated copper line wire.

DITCH.—Bryan, Ohio.—Contract for constructing tile and open ditch No. 219, Florence Township, has been awarded to CHAS. W. JONES, of Muncie, Ind., at $12,207. Bids were received on Aug. 19.

DRY DOCK.—Superior, Wis.—The BARNETT & RECORD CO., of Duluth, Minn., has been awarded the contract for enlarging the dry dock at Superior for the American Shipbuilding Co. Estimated cost, $50,000.

IRON FENCE.—Chicago, Ill.—Bids are asked by the Department of Public Works until 11 a. m., Sept. 5, to build and construct complete an iron fence at the 39th St. pumping station, located at 39th St. and Lake Michigan.

RIPRAP.—Wilmington, N. C.—Bids were received on Aug. 31 by Capt. Earl I. Brown, Corps Engrs., U. S. A., Wilmington, for 8,000 tons riprap stone. Contract was awarded to the SOUTHERN GRANITE CO., Stoneboro, S. C., at $1.72 per ton.

RAILROAD TRESTLE.—North Chicago, Ill.—Bids are asked by the Bureau of Navigation, Navy Dept., Washington, D. C., until noon, Sept. 17, for a railroad trestle to power-house, at the naval training station, Great Lakes, North Chicago, Ill.

DRAINAGE.—Woodstock, Ill.—Bids are asked until Sept. 5 by the Drainage Commissioners of Drainage District No. 1 of the Town of Dorr, at Circuit Clerk's office, at Woodstock, for deepening and repairing the drainage ditch, about 50,000 yds. of earth to be excavated.

EXCAVATING CHANNEL.—Chicago, Ill.—G. M. Wisner, 1500 American Trust Bldg., Ch. Engr. Sanitary District of Chicago, states that bids will be received about Oct. 15 for excavating section of North Shore channel, between Lawrence and Foster Aves., to cost about $60,000.

REPAIRING BOATS.—New York, N. Y.—Bids are asked until noon, Sept. 10, by the Department of Street Cleaning for furnishing all the labor and materials required to repair the three steam dumpers of the Department of Street Cleaning, known as "Aschenbrödel," "Cencrentola" and "Cinderella."

CEMENT.—Devils Slide, Utah.—Contract has been awarded to the UNION PORTLAND CEMENT CO., of Ogden, Utah, for furnishing 2,000 barrels of Portland cement for use in constructing the Strawberry Valley Irrigation project, Utah, at $1.10 per barrel, f. o. b. cars at Devils Slide, Utah.

FIRE-ALARM SYSTEM.—Clinton, Iowa.—Bids will be received until Sept. 8 by Wm. E. Hayes, City Clk., for furnishing material and constructing an underground fire-alarm system. Contractors are to furnish all lead, do all splicing, connect with main duct, and do all digging, piping and placing lateral posts and boxes.

RIFLE RANGE.—Ottawa, Ont.—Bids are asked by the Department of Militia and Defense, Ottawa, until noon, Sept. 8, for the construction of a rifle range at Niagara-on-the-Lake.

Bids are asked until noon, Sept. 12, for the construction of a rifle range at Fort William, Ont.

TILE DRAIN.—Eldora, Iowa.—Bids were received on Aug. 20 by R. A. Vigars, County Audr., for constructing a tile drain in Drainage Dist. No. 5, requiring about 11,200 ft. 10, 12, 16 and 18-in. drain tile; also in Drainage Dist. No. 6, requiring about 10,050 ft. 10, 12, 14 and 16-in. drain tile. Contract was let to R. A. ELZY & CO., Marshalltown, Iowa.

*EARTH EXCAVATION.—Detroit, Mich.—Bids were received as follows by Lieut-Col. C. McD. Townsend, Corps Engrs., U. S. A., on Aug. 24, for earth excavation for lock pit at Sault Ste. Marie, Mich., 90,000 cu. yds.: Great Lakes Dredge & Dock Co., Chicago, Ill., 43 cts. a cu. yd.; total, $38,700; T. L. Durocher & John P. Conrick, Sault Ste. Marie, Mich., 47¾ cts.; total, $42,975.

*REVETMENT, ETC.—Milwaukee, Wis.—Bids were received as follows on Aug. 26 by Maj. W. V. Judson, Corps Engrs., U. S. A., Milwaukee, for building plank crib revetment, removing old pier, and dredging at Manistique Harbor: Columbian Construction Co., Muskegon, Mich., $43,719; Greiling Bros., Green Bay, Wis., $43,365. Itemized bids will be given next week under Contract Prices.

*LIGHT-HOUSE.—Baltimore, Md.—Bids are asked by the Light-House Engineer, Baltimore, until noon, Sept. 29, for the completion and delivery of the metal work for the Ragged Point Light-House, Potomac River, Md.

Bids are asked at same time for furnishing materials and labor of all kinds necessary for the erection of the Ragged Point Light-House, Potomac River, Md.

BOOKSTACKS.—Washington, D. C.—Only one bid was received on Aug. 27 for the installation of a covered bookstack in the southeast court of the Library of Congress, Washington: Snead & Co. Iron Works, Jersey, N. J., bookstack, exclusive of elevators, $219,990; three book elevators, $9,187; book shelves, 72 cts. each; newspaper stands, 90 cts. each.

DREDGING, DOCK.—New York, N. Y.—Contracts for improvement at Ellis Island, N. Y., have been approved by Acting Secretary Wheeler of the Department of Commerce and Labor. One of the contracts, for the construction of a wharf, was let to the NEW YORK STATE CONSTRUCTION CO., 80 Broad St., New York, the price being $23,171. The other contract was for dredging, and was let to the INTERNATIONAL DREDGING CO., New York, at $29,400.

CEMENT.—Minidoka, Idaho.—Contract has been awarded to the UNION PORTLAND CEMENT CO., of Ogden, Utah, for furnishing 5,000 barrels of Portland cement for use on the Minidoka irrigation project, Idaho. The bid of this company at $1.90 per barrel f. o. b. cars at points in Idaho between Minidoka and Burley, was the lowest of the eleven received, considering the cost of transportation from points of delivery quoted by other bidders.

ROCK, CEMENT, STEEL, ETC.—San Quentin, Cal.—Bids are asked by the State Board of Prison Directors at San Quentin Prison until 10 a. m., Sept. 12, for furnishing to the State Prison at San Quentin the following materials in the approximate amounts set forth: 15,000 cu. yds. crushed rock, 7,000 cu. yds. sand, 500,000 ft. lumber, 600 tons mild steel bars, 60 tons high carbon steel bars, 200 kegs nails, 2,000 lbs. iron wire, 20,000 bbls. Portland cement and two concrete mixers and hoists.

LEVEE.—Sacramento, Cal.—Bids are asked until 8 p. m., Sept. 7, by M. J. Desmond, City Clk., for improving portions of B St. levee and Brighton levee by increasing their heights to an elevation of 5 ft. above the high water plane of March, 1907, and extending their base to conform to a slope of 3 ft. horizontal to 1 ft. vertical from the water side of the crown, which crown shall not be less than 30 ft. in width on the B St. levee and not less than 18 ft. in width on the Brighton levee.

*CEMENT.—Detroit, Mich.—Bids were received as follows by Lieut.-Col. C. McD. Townsend, Corps Engrs., U. S. A., Detroit, on Aug. 24, for furnishing 10,000 lbs. of Portland cement—price, per bbl.: Burt Portland Cement Co., Saginaw, Mich. $1; the Hecla Co., Detroit, Mich., $1.089; Alpena Portland Cement Co., Alpena, Mich., $1.095; Newaygo Portland Cement Co., Grand Rapids, Mich., $1.11; Elk Cement & Lime Co., Elk Rapids, Mich., $1.22; Alpha Portland Cement Co., Chicago, Ill., $1.235; F. B. Spear & Sons, Marquette, Mich., $1.49; Lehigh Portland Cement Co., Cleveland, Ohio, $1.63; Universal Portland Cement Co., Chicago, Ill., $1.78.

*RIPRAP SEAWALL.—Boston, Mass.—Bids were received as follows by Lieut.-Col. Edw Burr, Corps Engrs., U. S. A., on Aug. 26 for building riprap seawall, Fort Heath, Winthrop, Mass., for 5,650 tons—price per ton of 2,000 lbs. for stone in place in riprap, including stone filling and paving: John Cashman, Quincy, Mass., $2.90; Thomas Fitz Gibbon, 40 Abbott St., Beverly, Mass., $2.60; William L. Miller, 19 Milk St., Boston, $2.74; Antony Cefalo, 35 Brooks St., Boston, $6; Lawler Bros., 16 City Sq., Charlestown, Mass., $2.40; W. H. Ellis, 18 Tremont St., Boston, $3.59; Graham Construction Co., 41 High St., Charlestown, Mass., $9.47; Michael McDonough, 25 Pleasant St., Swampscott, Mass., $2.90. For 70 cu. yds. excavation, Thos. Fitz Gibbon was lowest bidder, at 20 cts. a cu. yd. For 600 cu. yds. fill, the same bidder submitted lowest price, at 30 cts. a cu. yd.

*SEAWALL, ETC.—Fort Mason (San Francisco post-office), Cal.—Bids were received as follows by Maj. George McK. Williamson, Q. M., U. S. A., on Aug. 25, for construction at Fort Mason, San Francisco, Cal., of a seawall, crib-wall, transport wharves and sheds for new Army Supply Depot for Quartermaster's Department, U. S. A. Rankin, Kellogg & Crane are Archs., 1012 Walnut St., Philadelphia, Pa. (a) on plans and specifications prepared by the government, (b) on plans and specifications prepared by the bidder: Pacific Construction Co., 16 California St., San Francisco, (a) $1,447,000, (b) $1,147,000; American Construction Co., 338 Pine St., San Francisco, (a) $1,428,000; San Francisco Bridge Co., 865 Monadnock Bldg., San Francisco, (a) $1,286,000, (b) "B" $1,143,000, "C" $1,040,000 (two alternate plans); C. Leonardt and L. J. Mensch, 42 Market St., San Francisco, (b) $1,348,000; Penn Bridge Co., Beaver Falls, Pa., (b) $1,440,000.

LEVEE.—New Orleans, La.—Bids were received on Aug. 20 by the Board of Commissioners, Fifth Louisiana Levee District, Tallulah, Fla., at office of Board of State Engineers, Room 402, Cotton Exchange Bldg., New Orleans, La., for construction of following levee work: Wilson's Point Levee, East Carroll Parish—Enlargement: Contents, 50,000 cu. yds.; contract awarded to LACEY BROS., New Orleans, at 19¾ cts. Cottonwood Levee, East Carroll Parish—Enlargement; contents, 25,000 cu. yds.; LACEY BROS., at 23.9 cts. Point Lookout Levee, East Carroll Parish—Enlargement and new levee; contents, 115,000 cu. yds.; LACEY BROS., at 18½ cts. Christmas Levee, Madison Parish—Enlargement; contents, 100,000 cu. yds.; bids rejected. Diamond Island Levee Topping, Madison Parish—Contents, 55,000 cu. yds.; B. T. BARROW, at 38.6 cts. Rifle Point Levee, Concordia Parish—Enlargement; contents, 120,000 cu. yds.; CLARK & GIBSON, at 24.9 cts. Minorca to Palo Alto Levee, Parish of Concordia—Enlargement; approximate contents, 110,000 cu. yds.; R. T. CLARK, at 19.68 cts. J. T. McClellan, Pres.

CANAL.—Buffalo, N. Y.—The Erie & Ontario Sanitary Canal Co. has been incorporated at Buffalo to construct a drainage and power canal from Lake Erie just south of Buffalo to Lake Ontario, at Olcott, a distance of 38 miles, at an estimated cost of $20,000,000. The initial capitalization of the company is $100,000. The plans of the company show a canal 100 ft. wide and 20 ft. deep, extending from the Buffalo River at the easterly line of the city of Buffalo northeasterly to Lockport, where power will be developed and the locks will be located, there being a fall of 326 ft. between the levels of Lake Erie and Lake Ontario, and from Lockport northerly to Olcott. The Sanitary and Power Canal will connect with the Erie Barge Canal by lock south of Lockport, allowing canal barges to enter and navigate the canal, along which dockage and manufacturing sites will be provided, for the establishment of factories which will utilize the electric power to be developed at Lockport with a flow of 6,000 cu. ft. per second. Buffalo River, Smokes Creek and Ellicott Creek will have their currents reversed and flow into the Sanitary Canal instead of into Lake Erie and the Niagara River, and in addition to the development of power the canal will dispose of the sewage of Buffalo, South Buffalo, West Seneca and the towns along its course, which, it is stated, would remove the danger of sewage pollution of the water supply of Buffalo and the cities of Tonawanda and Nigara Falls, besides abating the spring floods and freshets to which the Buffalo River is now subject. The canal will cause no interference with railroads entering Buffalo, as it will pass under all the railroads entering from the east by a tunnel four miles long, having its northerly entrance at Williamsville. The carrying out of the plan is contingent upon securing the consent of the Federal Government to the diversion of the necessary water from Lake Erie.

VESSELS.—Washington, D. C.—Bids were received as follows, Sept. 1, 1908, by the Secretary of the Navy for furnishing the Government with ten 742-ton torpedo boat destroyers, Nos. 22 to 31, and three colliers, carrying 7,200 tons dead weight, at a speed of 12 knots. The bids on torpedo boats were on Class 1, boats on Government's designs of hull and machinery, making 29½ knots, to be completed in 24 months; Class 2, on bidder's design of machinery, Government's design of hull and equipment, varying rates of speed and times of completion:

Torpedo boat destroyers—Bath Iron Works, Bath, Me., Class 1, two, $644,000 each; Class 2, (a) two, $597,000 each, 30 knots, 21-22 months' time; (b) two, $564,000, 30½ knots, 20-21 months' time; 700 tons displacement. Fore River Shipbuilding Co., Quincy, Mass., Class 2 (a) two, $638,000 each, 32 knots; (b) two, $688,000 each, 33 knots; (c) two, $665,000, 32 knots; (d) $610,000, 29½ knots; (e) $624,000, 29½ knots; time in each case, 23-24 months. New York Shipbuilding Co., Camden, N. J., Class 1, two, $665,000; Class 2, two, $685,000; 30½ knots; 24 months' time. William Cramp & Sons Ship & Engine Building Co., Philadelphia, Class 1, two, $669,000; Class 2, two, $664,000; 30 knots. Maryland Steel Co., Sparrow's Point, Md., Class 1, two, $708,300; Class 2, three, $703,600. Newport News Shipbuilding & Dry Dock Co., Newport News, Va., Class 1, two, $620,000; Class 2, two, $648,000; 31 knots; 24 months.

Colliers—Maryland Steel Co., one, $491,000; two, $482,500; three, $479,600; 10-12 months. Alternate proposition, one, $510,000; two, $501,500; three, $498,600; 10-12 months. Newport News Shipbuilding & Dry Dock Co., on three, $524,000 each; 12-14 months. New York Shipbuilding Co., one, $590,000; two, $575,000; three, $570,000; 12-14 months. William Cramp & Sons Shipbuilding & Engine Co., one, two, or three, $525,000 each; 12-14 months; carrying capacity, 7,620 tons; payments to be made in equal monthly installments beginning with signing of contract.

CONTRACT PRICES.

[Where * precedes item under Contract Prices the work was advertised in Engineering News.]

WATER MAIN.—Seattle, Wash.—Bids in detail were received as follows on Aug. 1, by C. B. Bagley, Secy. Bd. Pub. Wks., for the construction of the new main for the city in the Cedar River Valley water supply system, No. 2—(A) GRANT SMITH & CO., Portland, Ore. (awarded contract); (B) James Black Masonry & Construction Co., 1101 Alaska Bldg., Seattle:

		(A)	(B)
1	Venturi meter, in 60″ pipe	$3,600.00	$4,000.00
1	Venturi meter, in 51½″ pipe Pressure Pipe—	3,300.00	3,850.00
50	acres clearing and grubbing	100.00	200.00
30	acres clearing and grubbing	400.00	300.00
10,000	cu. yds. solid rock excavation, trenching, hauling backfilling, etc.	2.00	3.00
24,000	cu. yds. loose rock excavation, trenching, back-filling etc.	.90	1.25
306,000	cu. yds. other material, excavation, trenching, hauling, etc.	.70	.70
40,000	ft. B. M. timber in culverts and bridges	30.00	50.00
2,000	lbs. of wrought-iron bolts	.06	.07
1,000	lin. ft. 2″ sewer pipe	1.00	1.00
1,000	lin. ft. 16″ sewer pipe	1.80	1.50
10,000	ft. B. M. lumber necessarily used in railroad crossings.. Stave Pipe—	30.00	50.00
300	lin. ft. 42″ stave pipe	1.30	2.00
22,200	lin. ft. 48″ stave pipe	1.50	2.00
55,600	lin. ft. 51½″ stave pipe	2.00	2.25
2,000	lin. ft. 54″ stave pipe	2.25	2.50
62,000	lin. ft. 60″ stave pipe	2.40	2.50
7,599,000	lbs. steel bands	.05	.0454
38	—6″ blow offs, with 6″ gate valve and cast-iron extension valve box	50.00	48.00
2,000	lin. ft. 6″ Kalamein waste pipe	1.50	1.60
40	—4″ air valve, with 4″ gate valve	100.00	63.00
350	lin. ft. 3″ galv. iron stand pipes	1.00	.50
13	—3″ service cocks	6.00	10.00
32,000	lbs. cast-iron fittings	.09	.08
1	—42″ gate valve, with brick chamber	2,000.00	1,550.00
1	—36″ gate valve, with brick chamber	1,500.00	1,500.00
1,060	lin. ft. 51½″ steel pipe, ⅜″ in thickness	14.00	14.00
970	lin. ft. 51½″ steel pipe, 7/16″ in thickness	16.00	16.00
940	lin. ft. 51½″ steel pipe, ½″ in thickness	19.00	18.00
3,950	lin. ft. 51½″ steel pipe, 9/16″ in thickness	21.00	20.00
2,150	lin. ft. 48″ steel pipe, 5/16″ in thickness	12.00	10.00
850	lin. ft. 48″ steel pipe, ⅝″ in thickness	13.00	12.00
18	—14″ × 16″ manholes	60.00	60.00
1	—4″ air valve, with 4″ gate valve	100.00	63.00
3	—6″ blow-offs, with 6″ gate valve and cast-iron extension valve box	50.00	60.00
1,000	lin. ft. 6″ Kalamein pipe Black River Crossing—	1.50	1.50
140	lin. ft. 51½″ submerged steel pipe, 9/16″ in thickness, in place inclusive of excavation and refilling trench in Black River	50.00	50.00
	Tunnel—		
700	lin. ft. of tunnel, 6½′ × 6½′ in the clear, complete and back filled	15.00	12.00
	Replacing Pavements—		
100	sq. yds. Macadam pavement, taken up and replaced..	1.00	1.50
700	sq. yds. asphalt pavement, taken up and replaced..	3.00	3.50
	Total	$1,172,858	$1,178,712

FILL.—Pittsburg, Pa.—Bids were received on Aug. 3 by the City Controller for the construction of filters, pipe gallery, conduits, piping, fixtures and appurtenaces in O'Hara Township, Allegheny County, Pa., for the City of Pittsburg. Alexander B. Shepherd is Acting Dir. Pub. Wks. (Table of itemized bids received for this work on June 29 was given in the issue of July 23 under Contract Prices. These bids were rejected.) Itemized bids received on Aug. 3 were as follows: (A) Engineer's estimate; (B) WESTWATER & CASEY, Columbus, Ohio (awarded contract); (C) Booth & Flinn, 1942 Forbes St., Pittsburg; (D) M. O'Herron, First and McKean Sts.:

		(A)	(B)	(C)	(D)
1,300	ft. fence	$0.50	$0.40	$1.00	$1.10
12,000	cu. yds. excavation top soil	.35	.50	.50	.60
186,000	cu. yds. general excavation	.25	.30	.46	.60
8,000	cu. yds. excavation in trench	1.00	1.00	.70	.75
110,000	cu. yds. filling on property east	.25	.30	.30	.30
11,000	cu. yds. embankment	.30	.40	.49	.40
65,000	cu. yds. filing over vaulting	.30	.45	.40	.45
1,000	cu. yds. broken stone or gravel filling	1.25	1.50	.75	1.00
11,000	cu. yds. concrete in floors	5.75	6.50	7.00	6.00
2,500	cu. yds. concrete in walls	6.50	6.60	7.50	7.00
1,700	cu. yds. concrete in piers	7.50	7.50	7.50	7.50
11,200	cu. yds. concrete in vaulting	5.25	6.50	6.50	7.00
442,000	sq. ft. arch centering	.08	.13	.10	.10
1,100	cu. yds. reinforced concrete in conduit and drains	9.50	8.10	9.00	9.00
3,900	cu. yds. misc. reinforced concrete	10.00	12.50	9.00	9.00
100	cu. yds. concrete in trench	7.00	9.50	7.50	8.00
480,000	lbs. steel reinforcement	.035	.04	.035	.045
50	cu. yds. brick masonry	12.00	15.00	12.00	15.00
1,000	sq. yds. waterproofing	.75	1.25	1.25	1.00
220	ft. 57-in. riveted steel pipe	13.50	13.50	10.00	15.00
300	ft. 54-in. riveted steel pipe	12.50	13.10	10.00	14.00
360	ft. 48-in. riveted steel pipe	11.00	11.30	10.00	12.00
360	ft. 42-in. riveted steel pipe	10.00	10.50	10.00	11.00
340	ft. 30-in. riveted steel pipe	9.00	8.55	10.00	10.00
4.1	tons cast steel special	200.00	140.00	100.00	130.00
85	tons c.-i. hub and spigot pipe	45.00	60.00	50.00	60.00
21	tons c.-i. hub and spigot pipe specials	90.00	95.00	90.00	80.00
35	tons c.-i. flanged specials	120.00	145.00	100.00	120.00
4,000	lbs. brass pipe and fittings	.30	.40	.30	.45
3	2-in. brass air cocks, each	4.00	10.00	10.00	12.00
5	1-in. brass air cocks, each	2.00	2.50	10.00	9.00
10	filter ent. doors, each	800.00	800.00	550.00	1,000.00
10	20-in. bevel gear stop valves, each	130.00	120.00	150.00	147.00
10	20-in. spur gear stop valves, each	120.00	117.00	150.00	147.00
20	20-in. Stop valves, each	110.00	90.00	125.00	110.00
3	16-in. stop valves, each	85.00	65.00	85.00	80.00
10	12-in. spur gear valves, each	50.00	65.00	100.00	84.00
10	12-in. stop valves, each	45.00	41.00	60.00	50.00
2	10-in. stop valves, each	35.00	33.00	50.00	47.00
5	3-in. stop valves, each	10.00	6.00	15.00	9.00
60	indicator stands, each	20.00	18.00	20.00	21.00
60,000	lbs. miscellaneous w.-i. and steel	.06	.05	.05	.05
18,000	lbs. misc. cast-iron	.05	.05	.05	.05
11	manhole frames and covers, each	15.00	7.00	20.00	15.00
19	catch basin frames and covers, each	12.00	12.00	20.00	15.00
80	ventilator frames and covers, each	12.00	15.00	20.00	20.00
	Steam piping, lump sum	1,000.00	2,000.00	2,000.00	2,100.00
1,600	sq. ft. skylights	1.40	1.30	2.00	1.50
	Gal. partitions and finishing, lump sum	600.00	1,000.00	1,000.00	1,100.00
260	ft. pipe railings	.85	.75	2.25	1.00
1	Venturi meter	850.00	1,200.00	1,500.00	1,400.00
850	tons tee rail	55.00	50.00	50.00	50.00
85,000	lbs. cast steel brackets	.08	.08	.05	.05
2,600	sq. yds. telford-macadam roadway	1.40	1.30	1.40	1.50
900	sq. yds. macadam paths	1.00	.75	1.00	1.00
450	ft. concrete curb and gutter	.75	.60	1.00	1.10
350	sq. yds. paved gutters	3.00	2.25	2.75	2.50
500	ft. 6-in. terra cotta pipe	.25	.25	.40	.35
300	ft. 10-in. terra cotta pipe	.50	.40	.60	.45
	Gallery entrance, lump sum	7,000.00	7,000.00	10,000.00	8,000.00
15	acres seeding	60.00	100.00	75.00	110.00
700	sq. yds. sodding	.50	.50	.75	.50
	Extra work	.....	.....	.....	.....
	Total	$480,648	$570,406	$574,577	$598,843

BRIDGE.—Waterford, N. Y.—The itemized prices of the bids received by F. C. Stevens, Supt. Public Works, on Aug. 27, for constructing plate girder bridge over the Champlain canal at Mohawk St., Waterford, were: (A) M. Fitzgerald, Hoosick Falls, N. Y.; (B) JOHN W. FLYNN, Waterford, N. Y. (awarded contract):

		(A)	(B)
	Clearing, lump sum	$100.00	$100.00
200	cu. yds. grubbing	.60	.60
11,050	cu. yds. excavation	.50	.20
10,000	cu. yds. embankment	.15	.34
300	cu. yds. second-class concrete	7.00	.08
12	cu. yds. reinforced concrete	10.00	6.75
2	cu. yds. back wall coping	8.00	12.00
1,000	sq. yds. first-class stone paving	1.50	11.00
15	lin. ft. 8-in. vitrified pipe	.10	1.50
1,350	sq. yds. brick paving complete in place	2.25	.75
120	sq. yds. wooden pavement	3.00	2.00
2,800	sq. ft. Portland cement sidewalks	.22	3.00
1,450	lin. ft. concrete curbing	.60	.16
700	lin. ft. guard rail	.50	.40
725	lin. ft. pipe rail	1.50	.25
64	lin. ft. lattice railing	2.00	1.00
48,000	lbs. structural steel	.04½	1.50
1	cu. yd. brick masonry	25.00	.04½
90	sq. ft. expanded metal	.10	17.00
	Moving house, lump sum	200.00	.10
1,000	F. B. M. sawed lumber, yellow pine, per M.	60.00	195.00
1,000	lbs. metal reinforcement	.04	50.00
	Totals	$20,016	.04 $16,165

U. S. POSSESSIONS AND CUBA.

*POST-OFFICE.—Porto Rico.—Bids are asked until 3 p. m., Oct. 19, by Supervising Architect, Treasury Dept., Washington, D. C., for the construction complete (except elevators), of the U. S. Post-Office and Court-House at San Juan, Porto Rico.

CABLEWAYS.—Panama. — The Isthmian Canal Commission has awarded the LIDGERWOOD MFG. CO., 96 Liberty St., New York, contract for construction of one cableway and six duplex cable railways, for the carrying of cement for the construction of the Gatun locks and dams. The bid of the Lidgerwood Co. was $309,000.

*ELECTRIC INDUSTRIAL RAILWAY.—Panama.—Bids are asked by Capt. F. C. Boggs, Corps. Engrs. U. S. A., Gen. Purchasing Officer, Isthmian Canal Commission, Washington, D. C., until 10.30 a. m., Sept. 28, for electric industrial railway, consisting of 15,600 ft. of trackage with twelve electric locomotives and 24 flat cars.

LUMBER.—Panama.—Bids were received as follows on Aug. 24, at the Isthmian Canal Commission, Washington, for furnishing (a) 72,000 cypress cross-ties, and (b) 1,000,000 ft. B. M. of long leaf yellow pine lumber: American Tie & Timber Co., 11 Broadway, New York, (a) $53,784, 99 days; 35,000 ties for 72.9 cts. each, delivered in 50 days; 35,000 ties for 74 cts. each, delivered in 45 days. A. S. Bacon & Sons, Savannah, Ga. (a) $57,600, 200 days; (b) $24,000, 150 days. G. S. Baxter & Co., 15 William St., New York, (a) $54,288, 90 days. Bay Shore Lumber Co., Mobile, Ala., (b) $22,500, 100 days. Central Metal & Supply Co., Baltimore, (b) $31,200, 120 days. Chicago Lumber & Coal Co., St. Louis, Mo., (b) $24,500, 80 days. Cooney, Eckstein & Co., 66 Broad St., New York, (b) $23,700, 120 days. Dixon Lumber Co., Savannah, Ga., (b) $28,000, 120 days. G. Elias & Bro., Buffalo, N. Y., (a) $53,820, 150 days; (b) $24,800, 120 days. Arthur Gamwell, Seattle, Wash., (a) $70,560; (b) $22,500, both 90 days. Wm. D. Gill & Sons, Baltimore, (b) $26,400, 120 days. D. L. Gillespie & Co., Pittsburg, (a) $53,640, 120 days; (b) $22,950, 75 days. Geo. R. Johnson, Baltimore, (b) $26,400, 90 days. Lewis & Howell, Conway, S. C., (a) $62,640, 180 days. L'Hote Lumber Mfg. Co., New Orleans, (b) $33,000, 180 days. L. J. Merriman, Wilmington, N. C., (a) $49,320, 120 days. H. L. McConnell, Mobile, (b) $28,000, 100 days. S. E. Naylor & Co., Gulfport, Miss., (b) $23,600, 60 days. Sabine Lumber Co., New Orleans, (b) $27,700, 90 days. Southern Sawmill Co., New Orleans, (b) $24,500, 118 days. Southern Trading Co., New Orleans, (a) $75,600, 200 days; (b) $24,000; no time stated. Salmen Brick & Lumber Co., New Orleans, (b) $25,750, 120 days. W. R. Grace & Co., New York, (b) $24,000, 70 days. Award on these classes has been made as follows: BAY SHORE LUMBER CO., Mobile, Ala., (b) $22,500. L. J. MERRIMAN, Wilmington, N. C., (a) $49,320.

CIVIL SERVICE EXAMINATIONS.

FERMENTATION CHEMIST.—Washington, D. C.—The U. S. Civil Service Commission announces an examination on Sept. 14 to secure eligibles from which to make certification to fill a vacancy in the position of Fermentation Chemist, $2,500 a year, Bureau of Chemistry, Department of Agriculture, and vacancies requiring similar qualifications as they may occur in that Department at the same or lower salary. Age limit, 25 to 45 years. Application Form 304 and special form. Applications must be filed prior to closing hour on Sept. 14.

TOPOGRAPHIC DRAFTSMAN.—Washington, D. C.—The U. S. Civil Service Commission announces an examination on Sept. 9-10 to secure eligibles from which to make certification to fill a vacancy in the position of Topographic Draftsman (male), $1,000 a year, Coast and Geodetic Survey, and vacancies requiring similar qualifications as they may occur in any branch of the service. The salary for the position of Topographich Draftsman ranges usually from $1,000 to $1,500 a year, and for Copyist Topographic Draftsman from $900 to $1,500 a year. Age limit, 18 years. Application Form 1312.

For other Proposal Advertisements see pages 43, 44, 45, 46, 49, of Advertisements and Construction News page 88.

PUMPING PLANT.

McGee Creek Levee and Drainage District.
Pittsfield, Ill.

Sealed proposals will be received at the Law Office of Williams and Williams, Pittsfield, Ill., until Sept. 17, 1908, for furnishing and installing a 57,000-gal. per minute centrifugal pumping plant, to be located on the Illinois River about 3 miles below Meredosia, Ill.

Bids will be made in three parts:

A.—On the foundation, culvert and abutments.

B.—On the furnishing and installing the plant on the foundations.

C.—On the erection of the building on the foundation.

Specifications may be had by writing to Williams and Williams. Plans are on file in the same office.

Proposals must be accompanied by a certified check amounting to 5% of the bid.

The right is reserved to reject any or all bids.

R. T. SHAW,
W. T. REYNOLDS,
GEO. BAKER,
Commissioners.

WILLIAMS & WILLIAMS,
RAY ANDERSON,
Attorneys.
A. H. BEEL, Engineer.
E. R. BREAKER, Mech. Engr.

WE SUPPLY
BOOKS ON ANY SUBJECT
Engineering News Book Department

Situations Wanted

STRUCTURAL DRAFTSMAN.—Young man (27), technical graduate, 2 years' shop and erecting experience, 4 years detailing and checking columns, girders, trusses, floor and roof plans—now employed—desires change. Salary, $28.00 per week. Report on two weeks' notice. Address "L. 10," Engineering News, New York. 10-1t

M. E. GRADUATE—1904—4 years' all round experience, executive ability, not afraid of work, wants position in manufacturing concern as assistant superintendent. Location in New York City preferred. Address "C. A. 10," Engineering News, New York. 10-2t

Situations Open

WANTED—Instructor for free-hand drawing and sketching, lettering, mechanical drawing, descriptive geometry, natural perspective, stereotomy, etc., in eastern engineering school. Must be graduate of a high-class engineering school with several years' practice and preferable some teaching experience. Only men of high character and training, with strong endorsements, will be considered. Salary, from $1,000 to $1,400, according to qualifications. Position permanent for satisfactory candidate. Address "I. 10," Engineering News, New York. 10-2t

CHEMIST WANTED—By cement plant in middle West. State education, experience, references, salary wanted and how soon available. Address "K. 10," Engineering News, New York. 10-2t

BUILDING ESTIMATORS WANTED.—Wanted several reliable detail estimators, with Manhattan experience, capable of preparing detailed estimates of costs, under present conditions, of large buildings for factory, industrial and office purposes. Specialists in different sections such as building, construction, steam-heating, plumbing, lighting, etc., with experience with large general contractors in Manhattan preferred. Give qualifications and Manhattan experience. Address "M. 10," Engineering News, New York. 10-1t